Challenging Weight Loss: The Effectiveness of a 12 Week Weight Loss Challenge on Weight Loss, Physical Activity and Motivation.

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Dedication

To my parents. You always believed in me more than I believed in myself. I hope you are watching from heaven. I miss you and love you both.

Abstract

The objective of this study was to examine the effectiveness of a 12 week weight loss intervention in a commercial fitness centre on body mass index (BMI), moderate to vigorous physical activity (MVPA) and behavioural regulations consistent with Organismic Integration Theory (OIT, Deci & Ryan, 2002). The intervention group received weekly coaching sessions and bi-weekly seminars designed to increase MVPA and improve dietary intake. The results of the mixed model analyses of variance showed a significant within-subjects main effect for BMI ($F = 3.57$, $p = .04$). Changes in MVPA were not observed over time or between conditions. Changes in behavioural regulations congruent with OIT (Deci & Ryan, 2002) favoured the intervention condition. Study results indicate that 12 week weight loss challenges in commercial fitness centres may be effective to support the internalization process of exercise behavioural regulations but ineffective at producing sustainable weight loss or behavioural changes.

Keywords: weight loss challenge, commercial fitness centre, Organismic Integration Theory, BMI, moderate-to-vigorous physical activity

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CHAPTER ONE: INTRODUCTION

According to recent measured height and weight data, over one in four Canadian adults are obese (defined as having a measured Body Mass Index (BMI) of over 30 kg/m^2; Public Health Agency of Canada, (PHAC), 2011). With the inclusion of measured values within the overweight range (i.e., BMI = 25.00 – 29.99 kg/m^2) this figure increased to 62.10% of Canadians in 2008 (PHAC, 2011). Obesity has been linked with numerous chronic health conditions including hypertension, coronary arteriosclerosis, elevated cholesterol, type 2 diabetes, joint problems, stroke and many types of cancers (Blissmer, Riebe, Dye, Ruggiero, Greene, & Caldwell, 2006). Direct and indirect costs attributed to obesity range between $4.6 billion – 7.1 billion (CAD$) per annum based on 2008 estimates (PHAC, 2011). Collectively, the increased prevalence rates of overweight and obesity, combined with the increased risk of chronic health conditions and the associated costs highlight the importance of public health initiatives targeting both prevention and treatment of overweight and obesity in Canada (PHAC, 2011).

The Role of Physical Activity

Risk factors associated with body weight regulation are well known and include uncontrollable factors such as metabolic susceptibility, age and gender (Bouchard, Blair, & Haskell, 2007) and controllable factors such as energy intake and expenditure (Hill, Wyatt, & Peters, 2012). Extensive research has shown that the effect of increased physical activity on energy expenditure makes it effective for preventing weight gain and reducing body weight in overweight and obese populations and therefore, can be a

predictor of success in weight control (Hill et al., 2012; Jakicic, 2009; Shaw, Gennat, O'Rourke, & Del Mar, 2006).

Physical activity (PA) is defined as any body movement that increases overall energy expenditure above resting values (Bouchard et al., 2007). Total daily physical activity is comprised of several domains, including leisure time physical activity (LTPA; e.g., exercise, sport), occupational activity, commuting and household chores (van Tuyckom & Scheerder, 2010). LTPA does not include lifestyle embedded activities (e.g. incidental walking, household chores or personal care), commuting or active transport or activity performed in occupational settings (Bryan & Katzmarzyk, 2009). As a result of its effect on energy expenditure, LTPA is commonly prescribed as a means of weight regulation for both overweight and obese individuals and has been identified as one of the best predictors of long-term weight loss (Jakicic, Marcus, Gallagher, Napolitano, & Lang, 2003). Lower levels of LTPA are associated with higher levels of obesity in both Canadian men and women (PHAC, 2011). To derive health benefits, Canada's PA guidelines recommend that Canadians perform at least 150 minutes of moderate to vigorous intensity PA (MVPA) per week which may be accumulated in bouts of 10 minutes or more (Colley et al., 2011). MVPA for adults is defined as working at a minimum intensity of 3 times the intensity of rest (CSEP, 2011) or at a minimum of 3 metabolic equivalents (METS; WHO, 2013).

Despite public health recommendations, self-report data from the Canadian Community Health Survey shows that just more than half (53.80%) of Canadians over the age of 12 were reported to meet physical activity guidelines in 2011 (Statistics Canada, 2012). Research by Colley et al. (2011) showed that when using accelerometers to measure PA, the number of Canadian adults (>20 years) meeting the recommended

guidelines fell to 15.40%. It is important to note that the recommended accumulation of 150 minutes of MVPA per week is commensurate with health benefits (CSEP, 2011) however it falls short of the higher doses of MVPA (approaching 300 minutes per week) that appear to be required to effect weight loss (Catenacci & Wyatt, 2007; Jakicic, 2009; Jeffery, Wing, Sherwood, & Tate, 2003). Regardless of mode of measurement (i.e., self-report versus accelerometry) and classification criteria, it is evident that Canadians are not engaging in enough PA for either health benefits or weight regulation.

Lifestyle Interventions to Facilitate Weight Loss

Obesity is a complex medical condition with multiple etiologies (Sharma, 2007). Excessive body fat results from energy intake exceeding energy expenditure and is influenced by genetic, metabolic, biochemical, cultural and psychosocial factors (Lang & Froelicher, 2006). Approaches to affect weight loss, therefore, can and do vary greatly (Sharma, 2007). As such, meta-analyses of weight loss interventions report large heterogeneity in design and effectiveness (Michie, Abraham, Whittington, McAteer, & Gupta, 2009). Despite noted variation, interventions primarily adopt strategies to modify two lifestyle behaviours shown to have the greatest impact, specifically LTPA and dietary consumption (Lang & Froelicher, 2006; Sharma, 2007).[1]

PA-only interventions have been shown to effect weight loss (Hill et al., 2012), however; the results are often modest (i.e., less than 5kg) (Shaw et al., 2006) or less than 3% of initial body weight (Jakicic, 2009). Although the link between increased PA and weight control appears well established (Catenacci & Wyatt, 2007; Chaput et al., 2011; Donnelly et al., 2009), conflicting findings documenting the effectiveness of LTPA in the causation and maintenance of weight loss has been noted (Cook & Schoeller, 2011). Aerobic activity performed in the same amounts (i.e., energy expenditure per bout), has

been shown to both effect weight loss in some individuals and effect weight gain in others (Chaput & Sharma, 2011). For example, in a 12 week supervised aerobic exercise intervention, King et al. (2009) noted that almost half of the participants were classified as non-responders to PA due to either the very little weight lost (on average 0.9kg) or the weight gained over the length of the intervention. In the short term, the lack of response (i.e., weight loss) attributable to LTPA has been linked to either increased caloric intake or decreased non-exercise activity, and not a direct effect of the PA itself (Cook & Schoeller, 2011).

At the population level, physical inactivity is the determinant most strongly associated with obesity prompting a strong recommendation for increased LTPA for all Canadians (PHAC, 2011). However, with evidence both for and against the role of LTPA in weight loss (Cook & Schoeller, 2011) greater insight into the utility of interventions to facilitate weight loss and to determine their effectiveness is warranted. Furthermore, differences amongst specific components implemented within behavioural interventions may be implicated in the equivocal nature of the role of LTPA toward weight loss (Sharma, 2007). With this in mind, researchers have attempted to elucidate the components of behavioural interventions most linked to successful weight loss outcomes.

Length of Intervention. Interventions typically range from 8 weeks to 2 years with those lasting 6 months or longer reporting the greatest weight loss outcomes (Sharma, 2007). However, shorter interventions (i.e., 12 weeks) have also been shown to be effective in reducing weight in overweight and obese adults (Hays et al., 2004; Kraemer et al., 1997; Saris, Hul, & Baak, 2003; van Aggel-Leijssen et al., 2002). More recently, Jolly et al. (2011) conducted a 12 week eight-arm randomized controlled trial (RCT) weight loss intervention that compared several commercial weight loss programs

against primary care programs and a control group. They concluded that a 12 week intervention can produce clinically significant weight loss (on average 1.37 – 4.43 kg per person) that can be sustained for one year in an obese population.

The Exercise Prescription. Another source of variation amongst weight loss interventions is the duration and intensity of PA prescribed during the intervention. The duration prescribed in an intervention can range from 60 minutes to 240 minutes per week (Catennaci & Wyatt, 2007) and intensities can range from not intense at all (i.e., walking) to vigorous (i.e., jogging or resistance training; Blair, LaMonte, & Nichaman, 2004). As previously noted, the current recommendation of 150 minutes of MVPA per week to improve health (Colley et al., 2011) appears insufficient to effect weight loss or weight regain after weight loss (Catenacci & Wyatt, 2007; Jakicic, 2009; Jeffery et al., 2003; Saris et al., 2003). Important to note is that the increased number of minutes of MVPA that appear to be required for weight loss are independent of other lifestyle behaviours (i.e., changes in energy intake) which collectively impact weight loss (Jakicic, 2009) suggesting that a combination approach to weight loss may result in less minutes of MVPA needing to be performed.

Despite evidence in favour of increased PA to effect weight loss (Ohkawara, Tanaka, Miyachi, Ishikawa-Takata, & Tabata, 2007; Shaw et al., 2006; Silva et al., 2011), interventions utilizing PA alone report an average weight loss of 0.6-3.0 kg when compared against controls (Catenacci & Wyatt, 2007). A possible explanation for this small effect comes from Catenacci and Wyatt (2007) who found that interventions that prescribed greater amounts of PA (i.e., 60-90 min. daily) reported greater success leading them to conclude that greater amounts of exercise are needed to promote weight loss than are currently prescribed in most studies. Consequently, weight loss interventions

promoting changes in energy expenditure only may require the MVPA be in engaged in at levels considerably higher than guidelines for health (i.e., 150 minutes per week) or those often found in the literature (60-180 minutes per week; Catennaci & Wyatt, 2007; Stubbs & Lavin, 2013).

A Cochrane review on exercise for overweight or obesity found the intensity of PA prescribed also had a significant effect on body weight with more vigorous intensity PA inducing greater weight loss than that engaged in at a moderate or light intensity (Shaw et al., 2006). For this review, vigorous intensity was considered exercising at or above 60% of maximal oxygen consumption (VO2 max) or maximal heart rate (Shaw et al., 2006). Their definition of vigorous intensity corresponds with the moderate range recommended by Canada's PA guidelines and employed in the current study as MVPA, defined as 64-76% of maximal heart rate (Warburton, Katzmarzyk, Rhodes, & Shephard, 2007). The lack of a consistent definition of intensity across studies may also contribute to discrepant results regarding the effectiveness of PA for weight loss (Boutcher & Dunn, 2009).

The Dietary Prescription. The nutrition component of the behavioural approach to obesity can also differ between interventions (Hankey, 2010). Lower calorie and low fat diets are most commonly used in weight loss interventions (Shaw et al., 2006). A successful RCT designed to effect weight loss through increased LTPA and dietary changes conducted by Silva et al. (2010) outlined specific nutritional strategies for their female participants to adopt over the one year intervention which included: decreasing daily caloric intake by 300-400 kcal; eating breakfast; eating more frequent meals throughout the day; reducing dietary fat; increasing consumption of fruits and vegetables and decreasing consumption of highly processed foods and added sugars (Silva et al.,

2010). These dietary strategies are similar to those recommended by Health Canada within Canada's Food Guide to improve the health of Canadians (Bush & Kirkpatrick, 2003).

Weight loss is not a behaviour per se but instead a downstream outcome from the adoption or deletion of potentially multiple behaviours. Overall, general consensus is that interventions targeting both PA and dietary behaviours produce greater weight loss when compared against 'no treatment' controls or exercise only interventions (Sharma, 2007; Shaw et al., 2006). Based on their results of a recent meta-analysis, Michie et al. (2009) reported a small to moderate pooled effect size of 0.31 for weight loss interventions employing increased PA and healthy eating. Within their review, Shaw et al. (2006) concluded that diet-only interventions appeared to be more potent for weight loss than PA-only interventions. However, the role of exercise as a weight loss intervention was supported, especially when combined with dietary change (Shaw et al., 2006).

Participant Support. Another source of heterogeneity in study design is the amount and type of support each participant receives during the intervention. A review of behavioural interventions for preventing and treating obesity in adults revealed that interventions that utilized one-on-one counseling, were more successful than those that delivered their programming via group sessions (Sharma, 2007). More recent research suggests that 'mixed-mode' delivery (a combination of one-on-one and group sessions) may be more effective for weight loss up to 6 months however, the overall effect of delivery mode remains equivocal at this point (Greaves et al., 2011). Further differences have been noted when considering the mode of delivery of one-on-one counseling, with greater effect sizes evidenced when support was delivered face-to-face as opposed to via the internet (Conn, Hafdahl & Mehr, 2011).

Financial Incentives to Effect Weight Loss and Physical Activity Behaviour

Extending beyond behavioural components of weight loss interventions, researchers have examined the use of financial incentives or rewards for promoting health behaviour change including weight loss (Haggar et al., 2013; Lynagh, Sanson-Fisher, & Bonevski, 2013; Schwartz, 2009). The practice of adopting financial incentives in employee wellness programs is not novel (Moller et al., 2012). A survey of major United States employers in 2008 found that 70% of employee wellness programs used financial incentives to encourage either greater participation or performance (Moller et al., 2012). Although the practice is fairly common within wellness programs, the utility of financial incentives in weight loss interventions is still equivocal. While it appears that the use of economic incentives may encourage weight loss during the intervention period (Jeffery, Wing, Thorson, & Burton, 1998; Moller et al., 2012; Tucker, May, Bennett, Hymer, & McHaney, 2004; Volpp et al., 2008), an inverse relationship has been reported between the incentive and the maintenance of the weight lost (Moller et al., 2012; Paul-Ebhohimhen & Avenell, 2007; Volpp et al., 2008). A systematic review involving material incentives (e.g., money as either a cash reward, a lottery or deposit return or non-cash rewards such as food coupons or gifts) for weight loss produced no definite conclusion about their usefulness (Burns et al., 2012).

While equivocal as applied to weight loss outcomes, the provision of rewards has demonstrated some effectiveness towards behaviour change (Paul-Ebhohimhen & Avenell, 2007). From the analyses, the authors reported a few weak trends in favour of financial incentives with the primary goal: a) of using reward amounts greater than 1.2% personal disposable income, b) to reward behaviour change (e.g., increased PA and dietary change) as opposed to weight loss and c) to reward based on group performance

rather than individual performance (Paul-Ebhohimhen & Avenell, 2007). Interestingly, the weak findings with regard to the utility of a financial incentive to change behaviour may have more to do with the type of motivation (i.e., quality) it provides as opposed to the amount of motivation.

It has been hypothesized that the lack of sustainability, once the incentive has been removed, may be due to the "undermining effect" of the incentive on intrinsic motivation (Deci, Ryan & Koestner, 1999; Haggar et al., 2013; Moller et al., 2012). Moller et al. (2012) explored the effect of financial rewards in a healthy lifestyle behavioural intervention. Moller et al. (2012) measured participants' financial motivation towards healthy behaviour change and found the financial incentive was unrelated to behaviour change during the intervention and became negatively associated with behaviour change once the incentive was removed; providing the first evidence for the undermining effect within the context of a healthy living intervention (Moller et al., 2012). Haggar et al. (2013) further suggested that researchers should consider the functional significance of incentive based behaviour change (i.e., autonomous vs. controlling nature of the reward) in addition to social and environmental factors that influence human behaviour.

Motivation

The use of theory within health behaviour change research has been found to be useful at identifying salient constructs, increasing predictive potential and theoretical advancements (Sharma, 2007). Despite this knowledge, a review of behavioural interventions intended to prevent or treat obesity in adults revealed that the majority of interventions did not include constructs linked to known health behaviour theories (Sharma, 2007). Further, clinical reviews suggest that motivation to comply with

treatment regimens is the pivotal factor influencing behavioural approaches to weight control (Teixeira, Carraca, Markland, Silva, & Ryan, 2012a). Calls for integrating motivational theory with intervention efforts to address weight control have been forthcoming (Teixeira, Silva, Mata, Palmeira, & Markland, 2012b).

However, in a review of effective obesity interventions published by Powell et al. (2007), motivation in any form (quantity or quality) is notably absent from their list of successful components. Teixeira et al. (2012b) caution that the exclusion of motivational variables may limit the success of a weight loss intervention. They further suggest that a more effective approach should include examining the differences in quality of motivation on intervention outcomes.

Self-Determination Theory

Deci and Ryan's (2002) Self-Determination Theory (SDT) is a macro level theory of human motivation, emotion and personality that has been applied to behaviour change research to help define and explain the mechanisms behind initial and sustained participation (Ryan, Patrick, Deci, & Williams, 2008). SDT is based on the assumption that individuals have an innate propensity towards a unified sense of self (i.e., of being more self-determined; Deci & Ryan, 2002). Although this tendency is a fundamental component of human life, many factors can influence this proclivity for either the better or worse (Deci & Ryan, 2002). A systematic review of the PA and SDT literature produced compelling evidence for the value of SDT to understand and predict PA behaviour and weight loss (Teixeira et al., 2012a). Strong support was seen linking the more autonomous behavioural regulations and exercise with the more intrinsic forms of motivation predicting participation across a wide range of samples (Teixeira et al., 2012a).

Organismic Integration Theory

Within the framework of SDT exist smaller mini-theories to explain the components of human growth, assimilation and integration of the self within the social world that integrate together to form human behaviour (Deci & Ryan, 2002; Wilson, Mack & Grattan, 2008). Organismic Integration Theory (OIT) is the mini-theory within SDT that presents a multi-dimensional view of motivation and differentiates the quantity from the quality of motivation (Deci & Ryan, 2002). More specifically, Deci and Ryan (2002) suggest that higher levels of motivation (i.e., quantity) do not necessarily yield more desirable outcomes if the motivation is of a lower quality.

Deci and Ryan (2002) posit the motivation that regulates behaviour follows a continuum from amotivation (a lack of intention to act) to controlled (or external regulation) to autonomous (or intrinsic) motivation. Spanning these extremes are conceptually differentiated forms of extrinsic motivation that vary in the extent to which they present a unified sense of self. According to Ryan et al. (2008), controlled motivation is comprised of external behavioural regulation (motivated to obtain a reward or to avoid punishment) and introjected regulation (motivated to comply with a partially internalized regulation to gain pride/self-esteem or to avoid feelings of guilt or shame). Autonomous motivation includes identified (endorse the personal value and significance), integrated (assimilation of identified values and goals with other aspects of the self) and intrinsic regulation (engaging in behaviour for the intrinsic satisfaction of the behaviour alone). According to Deci and Ryan (2002), the shift from one type of motivation to the next along the continuum is a positive step in the integration and internalization process and one that may result in greater autonomous self-regulation, feelings of competence and improved behaviour change outcomes (Ryan et al., 2008). While both controlling and

autonomous regulations may energize and direct behaviour, engagement for autonomous motives is linked to greater long-term persistence, more adapted behaviour and well-being across varied domains (Deci & Ryan, 2002).

A review of three PA interventions that implicitly utilized SDT-based components found considerable support for the hypothesized motivational continuum (Fortier et al., 2012). Interventions that employ programming aligned with SDT (Deci & Ryan, 2002) have demonstrated greater improvements in measured outcomes (e.g., PA behaviour, PA motivation) when compared against controls (Fortier et al., 2012; Silva et al., 2010; Teixeira et al., 2012a). Silva et al. (2010) conducted a one year weight management intervention grounded in SDT (Deci & Ryan, 2002) in obese women and found that the individuals in the intervention condition achieved greater weight loss and reported greater PA at the end of the 12 months than the controls (Silva et al., 2010). Further, the association between autonomous regulation and increased PA was maintained at the two year mark with a significant direct effect between long-term weight loss and autonomous motivation for PA (Fortier et al., 2012). The positive association that has been shown to exist between higher levels of autonomous regulation and increased amounts of PA support the utilization of SDT in the context of PA and weight loss (Fortier et al., 2012).

Research Questions and Hypotheses

The research questions guiding the current study are: (1) Does participation in a weight loss challenge effect weight loss and MVPA when compared against a "do as you do" control group of fitness centre members in the short (12 weeks) and longer (6 months) term? and (2) What are the motivational mechanisms that underpin changes in weight loss and MVPA? The hypotheses that support these research questions are as follows:

H_1: Guided by research demonstrating the effectiveness of a 12 week exercise intervention (Jolly et al., 2011), participation in a short-term 12 week weight loss challenge was associated with greater reductions in weight loss and increased MVPA when compared against a control.

H_2: Consistent with Jolly et al. (2011) weight loss and increased MVPA immediately post intervention was sustained at 6 months.

H_3: Consistent with theoretical (Deci & Ryan, 2002) and empirical literature (Edmunds, Ntoumanis, & Duda, 2007; Silva et al., 2010; Teixeira et al., 2012a), those reporting more autonomous regulations for MVPA would report greater weight loss and physical activity in the short and long-term than those reporting more controlled motivation, regardless of condition.

H_4: Consistent with Silva et al. (2010), those participating in a weight loss challenge would demonstrate greater internalization and integration of regulations for exercise than those in the control condition.

Significance of the Study

The present investigation extends the extant literature to include consideration of short-term weight loss challenges within commercial fitness centres. A comprehensive search revealed that the bulk of weight loss intervention research has taken place within clinical and university settings (Shaw et al., 2006). However, there is evidence to support that commercial fitness centres are increasingly offering weight loss programming and challenges (Thompson, 2011; Tucker et al., 2004), as part of their offerings to club members. However, to date, little research could be found attesting to the utility of these programmatic offerings in commercial settings. The present study is relatively unique in its setting and approach as it was conducted in a commercial, multi-purpose fitness

facility. Such a setting is available year round to provide exercise and nutrition guidance to community members looking to lose weight or improve fitness. The availability of this type of programming may be more practical and convenient for the average person. Further, as the intervention took place within a commercial facility as opposed to a clinic or hospital, the stigma of attending a weight-loss intervention may be reduced (Schwartz, Chambliss, Brownell, Blair, & Billington, 2003). A successful wellness challenge for patients with Type II diabetes conducted in a commercial fitness centre concluded the need for primary care to align more with the community in order to successfully reduce obesity and chronic illness (Tucker et al., 2004). Therefore, the community setting may result in greater access and participation.

The effectiveness of combining both increased PA and healthy eating over diet or exercise alone to effect weight loss has been substantiated in the research (Sharma, 2007). The Cochrane review published in 2006 highlights that programs incorporating exercise improved weight loss marginally, however, when combined with dietary interventions, weight loss was improved considerably (Shaw et al., 2006). Building on this evidence the present study provided structured and uniform dietary[2] and exercise information delivered in weekly one-on-one sessions supplemented with behavioural goal-setting and exercise and food logging. The exercise component involved ensuring a balance between cardiovascular exercise and resistance training as well as an overall increased intensity of both. As previously noted, most weight loss interventions employing increased MVPA report significant but modest (less than 5kg) weight reductions immediately post intervention (Catenacci & Wyatt, 2007; Yancey et al., 2006). It has been proposed that this may be due to an insufficient amount of MVPA being prescribed to effect weight loss (Catenacci & Wyatt, 2007). As both weight loss and increased MVPA were the targeted

outcomes of this study, the participants were encouraged to accrue increased minutes of PA, in any increment, up to and including 300 minutes per week (Catenacci & Wyatt, 2007; Jakicic, 2009; Jeffery, Wing, Sherwood, & Tate, 2003).

Another strength of this study was the multiple and varied points of contact with the participants. Importantly, each challenge participant received weekly 60 minute one-on-one coaching/training sessions as face-to-face contact was identified as an integral component of interventions that were more successful at achieving maintenance of healthy behaviours (Conn et al., 2011; Fjeldsoe, Neuhas, Winkler & Eakin, 2011). As well, participants had access to bi-weekly educational seminars and cooking demonstrations that provided information about nutrition, preparing healthy meals, maximizing exercise results, stress management and behavior change.

The longitudinal design of this study was intended to identify the changes and variations of internalization of motivation that may be reported by the participants and apply these changes against the participants' measured outcomes to propose an underlying mechanism of change. It has been advocated that longitudinal studies be implemented to examine the process of internalization (Edmunds et al., 2007) with changes in reported behavioural motivation found to occur after a 12 week intervention (Wilson, Rodgers, Blanchard, & Gessel, 2003). The present investigation also considered the sustainability of change in motivation following the intervention period. Few weight loss studies incorporate a behavioural theoretical component within which to measure and potentially explain their results (Sharma, 2007; Teixeira et al., 2012b). However, an elucidation of the processes leading to internalization of behavioural regulations is beyond the scope of this study to interpret and explain as the motives were not specifically manipulated.

It has also been reported in the research that the majority of intervention studies (i.e., 65%) fail to conduct and report maintenance outcome data (Fjeldsoe et al., 2011). In their review, the defined timeframe Fjeldsoe et al. (2011) used for the evaluation of maintained behavioural outcome was at least 3 months post-intervention. The present study measured and evaluated 3 month post-treatment maintenance of MVPA behaviour change and weight loss. Behavioural interventions that focused on dietary behavioural changes reported more successful behaviour change maintenance than those that focused on PA and combined interventions only reported successful maintenance when a shorter definition of maintenance was applied (Fjeldsoe et al., 2011). With the consequences of being overweight/obese identified as a serious health concern in Canada (PHAC, 2011) and significant weight loss generally requiring at least 6 months (Sharma, 2007), it stands to reason that intervention research targeting health behaviour change and weight loss should be conducting and reporting maintenance data at the 6 month time point.

CHAPTER TWO: METHODS

Study Design and Procedures

The present study employed a quasi-experimental design. Participants self-selected their condition (intervention or control) and the outcomes of weight loss (as measured through BMI), PA participation and motivation regulation for exercise behaviours were measured over three time periods. Data collection at Time 1 captured the changes in the outcome variables from baseline immediately post intervention. Time 2 data collection measured the sustainability of any changes in the outcome variables from baseline to Time 1. A target sample size for each cohort ($n = 91$) was calculated based on a power analysis that used a moderate effect size ($r = 0.25$), five variables ($k = 5$), a fixed power ($\beta = 0.80$) for a given alpha level ($p < .05$) based on Cohen's (1992) recommendations. Assuming that recruitment was successful across the study, this would result in a total of at least 182 participants being enrolled at the time of study completion.

Following clearance by the Brock University Research Ethics Board (File: 11-096; see Appendix A), participants ($N = 88$) were recruited from the general membership of The Club at White Oaks in Niagara-on-the-Lake, Ontario. Individuals in the weight loss intervention ($n = 42$) were recruited via email and personal communication at a single time point from the participants who had registered for a 12 week weight loss challenge offered annually by the club. The Challenge began January 9, 2012 and ended March 31, 2012. Participants in the 'do-as-you-do' control condition ($n = 46$) were recruited through poster advertisements within the club (see Appendix B). Once initial contact was made, each participant was presented with a letter of information (see Appendix C) and informed consent (see Appendix D). It was clearly stated within the informed consent that challenge participants could withdraw from the present investigation at any point

without affecting their participation in the weight loss challenge.

Once consent was gained, each participant completed a Physical Activity Readiness Questionnaire (PAR-Q; see Appendix E). Two participants responded yes to one of the seven questions and was asked to receive a physician's clearance for participation in the study. At the start of the data collection period, participants were queried as to their preference of a male or female Canadian Society of Exercise Physiology (CSEP) assessor. Participants were then accompanied to a private assessment office within the facility for their body composition and anthropometric measurements with the CSEP assessor of their choice. Participants were then directed to a meeting room within the facility to complete a questionnaire package (see Appendix F) containing demographic and lifestyle information, self-reported PA measure and motivational regulations for exercise measure. Completion of the questionnaire package took approximately 20-30 minutes and the principal investigator was available to answer any questions that may have arose during the assessment period.

Measures

Demographic and lifestyle information. Relevant demographic, medical and weight control history was collected. Gender, marital status, education, employment status, ethnic origin and four current health condition were reported. Five items were developed to assess participants' weight control history (Sample item: During the last 12 months have you tried to lose weight?). Finally, participants completed a single-item measure assessing stages of change for PA consistent with the Transtheoretical Model (DiClemente & Prochaska, 1998).

Height and Body Weight. Each participant's weight (kg) was measured using a Seca scale calibrated to standard and height (m) was measured using a Gulick tape

measure affixed to a wall. Each participant's BMI was then calculated using the formula: BMI = weight (kg)/height $(m)^2$ (CSEP, 2010).

Self-Reported Physical Activity. A modified version of the Godin Leisure Time Exercise Questionnaire (LTEQ; Godin & Shepard, 1985) was used to measure self-reported participation in PA. For the present study, the LTEQ was modified to measure exercise duration in bouts of 10 minutes as opposed to the original bouts of 15 minutes. This modification was made to more closely align with the current Canadian PA guidelines. Previous studies using a similar version of the LTEQ have found support for the construct validity of test scores (Trinh, Plotnikoff, Rhodes, North, & Courneya, 2011; Karvinen, Raedeke, Arastu, & Allison, 2011). The modified LTEQ (Godin & Shepard, 1985) is a 3-item self-report LTPA measure assessing the frequency and duration of mild (i.e., easy walking, yoga), moderate (i.e., bicycling at a regular pace, easy swimming), and vigorous (i.e., heavy lifting, aerobics) PA performed in bouts of 10 minutes or more during a typical week. Scores for the moderate and vigorous PA were used in the present investigation to be consistent with intensity recommendations contained within Canada's PA guidelines. Total MVPA was calculated by multiplying each value with its corresponding MET as an estimate of energy expenditure using the formula: Σ[(Moderate $\times$ 5) + (Strenuous $\times$ 9)] (Godin & Shepard, 1985).

Reliability and validity of the LTEQ. Scores from the LTEQ have been validated in many studies (Trinh et al., 2011; Karvinen et al., 2011) and have been found to compare favourably with other self-report measures for PA as well as correlate with indicators of physical fitness expected as a function of more frequent exercise participation (Jacobs, Ainsworth, Hartman, & Leon, 1993). The LTEQ is easy to understand and scores from

this instrument appear stable across time using multiple test administrations (Rhodes, Courneya, Blanchard, & Plotnikoff, 2007).

Motivational Regulation for Exercise. The Behavioural Regulation in Exercise Questionnaire (BREQ-2R; Markland & Tobin, 2004; Wilson, Rodgers, Loitz, & Scime, 2006) is a 23-item self-report instrument developed to assess motivational regulations consistent with SDT (Deci & Ryan, 2002). The BREQ-2R contains six subscales measuring amotivation, external, introjected, identified, integrated and intrinsic regulations across a 5-point scale ranging from 0 (*not true for me*) to 4 (*very true for me*). For the present investigation, the amotivation items were removed from the BREQ-2R resulting in a modified 19-item instrument. Participants were asked to respond to each item following the stem "Why do you exercise?". Sample items included: "I exercise because other people say I should" (extrinsic regulation), "I feel like a failure when I haven't exercised in a while" (introjected regulation), "I get restless if I don't exercise regularly" (identified regulation), "I exercise because it is consistent with my values" (integrated regulation) or "I enjoy my exercise sessions" (intrinsic motivation).

The BREQ-2R is a modified version of the BREQ-2. Scores from the BREQ-2 have demonstrated construct validity (Markland & Tobin, 2004) and structural validity (Wilson & Rodgers, 2004). The BREQ-2R measures the motivational regulation "integrated" (assimilation of identified values and goals with other aspects of the self). The addition of the integrated subscale does not appear to affect the validity of the responses to the BREQ-2 and construct validity of test scores has been demonstrated in a community sample of exercisers (Wilson et al., 2006). The integrated regulation subscale also demonstrates internal consistency reliability and temporal stability allowing for the measurement of integrated regulation within an exercise context (Duncan, Hall, Wilson,

& Jenny, 2010; Wilson et al., 2006).

Upon completion of study measures at baseline, participants were then scheduled for their Time 1 appointment which took place 12 weeks later and were told they would receive a telephone reminder one week prior to their meeting. Upon completion of the baseline data collection, the intervention condition participants were assigned to their Personal Trainer/Precision Nutrition coach to commence their weekly coaching sessions and given the relevant information to access the additional educational programming available to them as part of the weight loss challenge. The control participants were instructed to "do-as-they-do" for the next 12 weeks.

The Weight Loss Challenge: The Intervention Condition

The annual weight loss challenge offered to the general membership at The Club at White Oaks consisted of pre- and post-challenge body composition and anthropometric measurements, weekly nutrition and exercise coaching sessions[4] provided by a Can-Fit-Pro (CFP) certified Personal Trainer and Precision Nutrition (PN) coach and bi-weekly educational programming[5] that alternated between healthy cooking demonstrations led by a certified chef and educational seminars led by a health educator. The weight loss challenge cost $170 per month for the three month program. A financial reward[3] was awarded to the top three finishers (those individuals that lost the greatest amount of weight) of the intervention condition during a recognition evening held within one week of the end of the Challenge. See study flowchart in Appendix G for greater details of the intervention.

The Weight Loss Challenge: The Control Condition

The participants in the control condition were recruited from the general membership of the same club who were not participating in the annual weight loss

challenge. The control condition participants were instructed to "do-as-they-do" for the duration of the study. Some of the control condition participants may have continued to utilize the personal training services offered at the club but did not have access to the educational programming that was offered as part of the weight loss challenge.

At the data collection period post-intervention (i.e., Time 1), participants' weight (kg) and height (m) were measured by the same CSEP assessor at the completion of the 12 week weight loss challenge. Each participant also completed the same questionnaire package excluding the demographic and lifestyle information. Upon completion of the Time 1 data collection, each participant was scheduled for their Time 2 appointment which took place 14 weeks later and was told that once again, telephone reminders would be sent out one week in advance. Participants from both conditions were then instructed to "do-as-they-do" for the next 14 weeks.

Data Analysis

Data analysis progressed in sequential stages. The data was first screened for missing values, outliers and examined for compliance with statistical assumptions. The demographic and lifestyle information variables were then analyzed through the appropriate non-parametric (e.g., χ^2) or parametric (e.g., *t*-test) statistic for each condition and also for completers versus non-completers. Estimates of internal consistency (Coefficient α; Cronbach, 1951) were calculated for each subscale of the BREQ-2R at each time point. Pearson bivariate correlations were computed between the variables of interest at baseline, Time 1 and Time 2. Patterns of associations were also examined using change scores over time. Standardized residuals were first calculated by performing linear regression analyses on each variable of interest using the baseline value

as the independent variable. The difference between the predicted and actual values was then saved as the standardized residual for that variable (Zumbo, 2007). Pearson bivariate correlations were computed between the standardized residuals of relevant study variables to determine patterns of inter-relationships between change scores (Δ). Finally, a series of mixed model Analysis of Variance (ANOVAs) were conducted with one between groups variable (intervention or control) and one within groups variable (Time) to examine differences between conditions and changes over time in the study variables measuring BMI, PA and behavioural regulations consistent with OIT. Complementing null hypothesis significance testing, effect size estimates (η_p^2) were interpreted. According to Stevens (1996), effect sizes of .01, .06 and .14 were interpreted as small, medium and large respectively.

CHAPTER THREE: RESULTS

Participants

Participants (N = 70) providing data at all three time points comprising this research study consisted of adult men (n = 17) and women (n = 53) between the ages of 23-65 years (M = 44.83 years; SD = 8.78 years). Participants were primarily Caucasian (92.9%, n = 65), married (67.1%, n = 47), university educated (87.1%, n = 61) and employed full-time (77.1%, n = 54). Participants reported a mean BMI of 29.79 kg/m^2; SD = 6.02 kg/m^2 at baseline. According to anthropometric guidelines (PHAC, 2011), 41.40% (n = 29) were classified as "overweight" (i.e., a BMI ranging from 25.00-29.99) and 38.60% (n = 27) were in the obese range (i.e., BMI > 30). Participants generally reported being free from diabetes (98.6%, n = 69) and cancer (98.6%, n = 69). No participant reported a diagnosis of heart disease or osteoporosis (100%, n = 70).

Most participants considered themselves to be overweight (81.40%, n = 57) and indicated that they would like to weigh less (94.30%, n = 66). As well, the majority of participants (78.60%, n = 55) indicated that they had attempted to lose weight within the last 12 months with most choosing to do so with the use of a Personal Trainer (64.30%, n = 45) as opposed to a Dietitian (8.60%, n = 6), Nutritionist (8.60%, n = 6) or doctor (5.70%, n = 4). Lastly, with regard to their participation in LTPA, the majority (52.90%, n = 37) reported they had been exercising regularly for more than 6 months at the time of study enrollment (i.e., maintenance stage of change). No participant reported being in the pre-contemplation stage of change.

No differences in baseline demographic and lifestyle information were found between individuals in the intervention and control conditions (p > .05; see Table 1). A series of t-tests were conducted to determine whether differences existed in BMI, LTEQ

MVPA and behavioural regulations across the two conditions at baseline. Differences were observed (p = .02) for introjected regulation as those in the intervention condition reported in engaging in exercise due to self-imposed pressures to a greater extent (M = 2.60; SD = 1.13) than those in the control (M = 1.88; SD = 1.34). No other significant (p > .05) differences emerged. Interpretation of effect sizes were small-to-moderate (d = .12 - .58; see Table 2).

Participant Attrition

Seven participants from the intervention condition dropped out of the study before the second data collection period and two more dropped out before the final data collection. Within the control condition, four participants dropped out before the second data collection followed by five more before the third data collection. Differences (p < .05) between those providing partial data (i.e., dropouts) and those providing data at all three time points (i.e., completers) were noted for age and being diagnosed with heart disease or osteoporosis. More specifically, those who were classified as dropouts were older and more likely to have heart disease or osteoporosis than those who completed the study.

Preliminary Analysis, Descriptive Statistics and Estimates of Internal Consistency

Data was screened for data entry error and missing values (i.e., participant non-response). With no data entry errors or missing data, descriptive statistics were calculated for study variables across all time points (see Table 2). With regard to distributional responses for the LTEQ items, this sample reported, on average MET scores in line with published data previously reported (see Table 2; Godin & Shepard, 1985; Wilson, Mack, Gunnell, Gregson, Cheung, Rimmer, & Sylvester, 2011). It should be noted, however, that the LTEQ scores for both Godin and Shepard (1985) and Wilson et al. (2010) were

taken from a composite of mild, moderate and vigorous activities as opposed to the two items assessing MVPA adopted in the present investigation. Minimal deviation of normality was demonstrated for LTEQ responses (skewness ranged from 0.19 to -0.14 and kurtosis ranged from 0.17 to -0.53) across the three test administration periods (Glass & Hopkins, 1996).

Interpretation of BMI values at baseline demonstrated that participants on average were "overweight" (M = 29.79 kg/m^2; SD = 6.02 kg/m^2; Health Canada, 2013). Over the three time points, the results for BMI appeared relatively normally distributed (skewness ranged from 1.20 to 0.96 and kurtosis ranged from 1.30 to 0.61; Glass & Hopkins, 1996).

Finally, with regard to distributional characteristics of the subscale scores measured from the BREQ-2R, regulations aligned with more autonomous motives for exercise were above the theoretical midpoints for their respective response options. Responses to items comprising more controlled regulations fell below the midpoint. Inspection of estimates of normality demonstrated some deviation (skewness ranged from 2.07 to -1.76 and kurtosis ranged from 4.25 to -0.95) for variables measuring behavioural regulations consistent with OIT (Glass & Hopkins, 1996). Estimates of reliability (Cronbach's α; Cronbach, 1951) were calculated for scores from the BREQ-2R with α values ranging from 0.83 to 0.94 (see Table 3).

Bivariate Correlations between Study Variables Across Conditions

Cross-sectional. Data were screened for bivariate normality and homoscedasticity using scatterplots. For individuals in the intervention condition, BMI scores demonstrated a small negative (albeit non-significant) association with LTEQ MVPA at baseline and Time 1 (r_{12}'s of -.19 and -.07 respectively; see Tables 4-6).

Statistical significance between BMI and LTEQ MVPA was achieved at Time 2 (r = -.39). For those in the control condition, higher BMI scores were associated with lower LTEQ MVPA (r_{12}'s = -.28 to -.54, $p \leq .05$) across the three test administration points.

At baseline, Pearson bivariate correlations between BMI and BREQ2R subscale scores demonstrated a pattern of weak-to-small relationships with more controlling forms of motivation (see Tables 4-6) with some deviation in statistical conclusions and direction noted. More specifically, those in the control condition demonstrated a pattern of statistically significant positive relationships with external regulation. While a positive relationship between external regulation and BMI was found for those in the intervention condition, statistical significance ($p < .05$) was generally not attained. Only the relationship at Time 2 between identified regulation and BMI (r = -.31) achieved statistical significance for the intervention condition. For those in the control condition, a positive correlation between introjected regulation and BMI was noted at all time points albeit non-significant at baseline and Time 1.

Higher BMI values were associated with lower autonomous motives for exercise regardless of condition across all time points. A pattern of small negative relationships with BMI scores emerged for those in the intervention (r_{12}'s ranged from -.15 to -.31) and control (r_{12}'s ranged from -.28 to -.35). Interestingly, within the control condition this pattern of association appeared to be more strongly correlated as statistical significance was achieved at all time points regardless of regulation assessed. A significant ($p < .05$) negative relationship between identified regulation and BMI in the intervention condition was achieved at baseline and Time 2.

A pattern of small-to- moderate positive correlations, generally in the expected direction, were seen between autonomous motives for exercise and LTEQ MVPA scores for both the intervention (r_{12}'s ranged from .08 to .46) and control (r_{12}'s ranged from .34 to .66) conditions. Of note was the finding that LTEQ MVPA scores were significantly associated with integrated and intrinsic regulation at Time 1 for those in the intervention condition. The magnitude of the correlations between LTEQ MVPA and BREQ-2R scores was statistically significant and in the expected direction at all time points for those in the control condition with the only exception being between LTEQ MVPA and introjected regulation at baseline and Time 1.

Interestingly, the pattern of association seen between the controlled motives for exercise and the LTEQ MVPA scores differed between the two conditions. A generally positive (albeit non-significant) correlation was seen between LTEQ MVPA and the controlled motives for exercise in the intervention condition (r_{12}'s ranged from -.01 to .23) across all three time points. In contrast, the relationship between LTEQ MVPA and the controlled motives for exercise in the control condition were negative (r_{12}'s ranged from -.03 to -.51) with the relationship to extrinsic regulation attaining significance ($p >$ .05).

Change over time. To measure the association of change over time between the study variables, correlations between the standardized residual scores were calculated (see Tables 7-9). Results partially supported study hypotheses as results of the bivariate change score analyses between BMI and LTEQ MVPA generally demonstrated a pattern of negligible-to-small negative relationships. As such, greater reductions in BMI were typically associated with greater self-reported LTEQ MVPA regardless of condition. It is important to note that the magnitude of the relationships between ΔBMI – ΔLTEQ

MVPA did not attain statistical significance with the noted exception of scores for the intervention condition between baseline and Time 1 (r = -.29).

With regard to the pattern between BMI and the BREQ-2R subscales, a pattern of negligible to small correlations were observed. Significant ($p < .05$) associations were noted when examining change scores for those in the intervention condition for identified (r = -.28) and integrated (r = -.35) regulations from baseline to the end of the intervention period. As such, across the 12 week weight loss challenge, greater reductions in BMI were associated with greater endorsement of identified and integrated regulations for exercise. For those in the control condition, greater reductions in BMI were associated with greater increases in intrinsic regulations (r = -.29; $p < .05$) from baseline to Time 2.

Finally, interpretation of change scores between LTEQ MVPA and BREQ-2R was conducted. Results typically revealed a pattern of weak to moderate relationships between changes in LTEQ MVPA and behavioural regulations for exercise behaviour. When examining scores from baseline to Time 1, increases in LTEQ MVPA were associated with greater endorsement of controlled and autonomous regulations for exercise (r_{12}'s ranged from .25 to .42) (see Table 7) for those enrolled in the intervention condition. The largest (and only statistically significant) association was noted between LTEQ MVPA and identified regulation (r = .42, $p < .01$). Within the control condition, a similarly positive, albeit slightly larger, association was noted between the change in LTEQ MVPA and the more autonomous regulations for exercise (r_{12}'s ranged from .28 to .53, $p < .05$) (see Table). Increases in LTEQ MVPA across the twelve week period were also associated with less endorsement of external regulation ($p < .05$) for those in the control condition.

The increase in LTEQ MVPA noted in the intervention condition during the follow-up period of the present investigation (Time 1 – Time 2) remained positively associated with the more autonomous regulations for exercise (r_{12}'s ranged from .19 - .36) (see Table 8) however, the strongest (and statistically significant) association shifted from identified regulation to intrinsic regulation ($r = .36$, $p < 0.05$). Although an increase in LTEQ MVPA was measured within the control condition during the follow up period (Time 1 to Time 2), the positive relationship between LTEQ MVPA and the more autonomous regulations for exercise became non-significant and weaker (r_{12}'s ranged from .03 to .21) however, the relationship between LTEQ MVPA and the more controlled regulations for exercise became more strongly negatively related and achieved statistical significance ($r = -.47$, $p < .01$ for extrinsic regulation and $r = -.32$, $p < .05$ for introjected regulation) (see Table 8).

Over the course of the present investigation, the pattern of a positive association between LTEQ MVPA and autonomous regulation for exercise behaviour continued in the intervention group (see Table 9). The only noted difference from the correlations between the change scores from Time 1 to Time 2 was an increase in strength of the relationship and statistical significance between LTEQ MVPA and identified regulation ($r = .36$, $p < .05$). Whereas within the control condition, the relationship between LTEQ MVPA and the more controlled regulations for exercise became smaller and weaker (r_{12}'s from -.19 to -.21) and the relationship with intrinsic regulation attained statistical significance ($r = .31$, $p < .05$).

Main Findings

To determine whether there were differences in the study variables between conditions over time as well as to determine the interaction between condition and time, a

series of mixed model ANOVAs were conducted. The assumptions of a mixed-model ANOVA were met (Daniel, 2005) as the within-subject variable was measured at an interval level and the between-subject factor was measured at a nominal level. For the repeated measures, the assumption of normality for each of the study variables was tested. This assumption was violated for the variables of BMI, extrinsic, identified and integrated regulation over all three time points; and violated for intrinsic regulation at baseline and Time 1. The assumption of homogeneity of variance was tested using the Levene test. This assumption was violated at baseline for LTEQ MVPA and extrinsic regulation and violated at Time 1 for introjected and integrated regulation. To test the assumption of sphericity, the Mauchly Sphericity test was calculated. This assumption was violated for BMI, LTEQ MVPA and extrinsic regulation variables so the Greenhouse-Geyer correction was used (Daniel, 2005).

Changes in BMI within conditions over time. The results of the mixed model ANOVA indicated a significant main effect for BMI over the three time points (F(2, 118.35) = 3.57, p = .04, η^2 = .05) (see Table 10). Therefore, both conditions experienced a decrease in BMI over the length of the present investigation. The interaction effect between BMI and condition approached significance (F (2, 118.35) = 3.18, p = .052, η_p^2 = .05) (see Table 10) with a medium effect size. Further examination suggests that participation in the fitness challenge showed a decrease in BMI which approached statistical significance relative to the control group (p = .055) between baseline and Time 1. The effect size for the main effect of time and the interaction effect both indicated small-to-medium practical significance with the time effect being statistically significant and the interaction effect approaching significance. As hypothesized, the intervention condition on average decreased their BMI between baseline and Time 1 and the control

condition maintained their BMI. The decrease in BMI experienced by the control group occurred between Time 1 and Time 2.

Changes in LTEQ MVPA within conditions over time. No significant ($p > .05$) differences were found to exist in LTEQ MVPA within or between conditions over all three time points (see Table 10). The interaction term also did not achieve statistical significance.

Changes in behavioural regulations for exercise within conditions over time. Of the five BREQ-2R subscales measured, a significant within-subjects main effect was found for extrinsic regulation, a significant between-subjects main effect was found for introjected regulation and significant interaction effects were found for integrated and intrinsic regulations (see Table 10). With regard to extrinsic regulation for exercise, a significant main effect for time with a medium effect size was observed ($F(2, 136) = 4.99$, $p = .01$, $\eta_p^2 = .07$). Post hoc analyses revealed a significant decrease in extrinsic regulation between and Time 1 in both the intervention ($M_{Baseline} = .83$ and $M_{Time1} = .51$) and control condition ($M_{Baseline} = .61$ and $M_{Time1} = .40$; see Table 10). With regard to introjected regulation, a significant main effect for condition indicated a difference was observed with a medium effect size ($F(1, 68) = 5.21$, $p = .03$, $\eta_p^2 = .07$). The intervention condition reported higher internal sanctions for attaining rewards or avoiding punishment for behaviour across all time points when compared to the control condition.

With regard to the more autonomous forms of behavioural regulation for exercise, both integrated and intrinsic regulation showed a significant interaction effect (F (2, 136) $= 4.88$, $p = .01$, $\eta_p^2 = .06$ and F (2, 136) $= 5.00$, $p = .01$, $\eta_p^2 = .07$) respectively. Post hoc analyses revealed that those in the intervention condition more strongly endorsed integrated regulation between baseline and Time 1 ($p = .01$) in comparison to the controls.

While reasons for exercise linked to integrated regulations decreased in the post-intervention period for those in the intervention condition, they remained significantly (p = .02) greater than scores for those in the control condition. Post hoc analyses on intrinsic regulations for exercise indicate a significant increase from baseline to Time 1 (p = .01) for those in the intervention condition when compared to the control.

CHAPTER FOUR: DISCUSSION

The prevalence of overweight and obesity is increasing among Canadian adults (PHAC, 2011). Given the prevalence of obesity-related comorbidities (Blissmer et al., 2006), concerted efforts to prevent and treat obesity rather than just its associated effects are necessary. Increases in energy expenditure are effective for preventing weight gain and reducing body weight in overweight and obese populations (Hill et al., 2012, Jakicic, 2009). Therefore, strategies to increase energy expenditure through PA can be a predictor of success in weight control (Hill et al., 2012; Jakicic, 2009).

The present investigation examined the effectiveness of a 12 week weight loss challenge in a commercial fitness centre on weight loss, PA and motivation. Recognizing the impact weight loss and increased MVPA can have on long-term health (WHO, 2009), another purpose of this study was to examine the sustainability of any changes observed in the measured outcomes.

Contrary to study hypotheses and existing literature (Jolly et al., 2011), participation in the 12 week weight loss challenge was not associated with greater weight loss or an increase in MVPA when compared against a 'do as you do' control group. Our findings showed a significant effect of time on weight loss in both conditions with a decrease in BMI approaching significance ($p = .056$) in the intervention group from baseline to Time 1. Consistent with weight loss maintenance research, the noted decrease in BMI was not sustained 3 months following participation in the weight loss challenge (Stubbs et al., 2011). Contrary to our hypothesis however, no significant change in MVPA was reported in either condition over the course of the investigation. Consistent with our hypotheses and empirical research (Edmunds et al., 2007; Silva et al., 2010;

Teixeira et al.,2012a), a positive association was observed between greater weight loss and increased MVPA with the more autonomous regulations for exercise, in both the short-term and long-term, regardless of condition.

Comparison of Study Participants to those of Previous Research

Descriptive statistics on relevant study variables are useful to provide the context required to frame results with reference to existing literature and inferential statistics. The sample from the present investigation was predominantly Caucasian, middle-aged females. The majority of participants in weight loss interventions are generally between 36-55 years of age (Wu, Gao, Chen, & van Dam, 2008) with a reported mean age of 42.4 years (Shaw et al., 2006). No clear associations have been shown in the literature between age and ethnicity and the effectiveness of the intervention on weight loss (Greaves et al., 2011). It is common in weight loss interventions to have greater participation from females than males (Morgan, Warren, Lubans, Collins & Callister, 2011) and when studies report their results separated by gender, males report greater weight loss than females (e.g., Boutcher & Dunn, 2009). Based on baseline measurements, participants in the present investigation were classified as overweight (PHAC, 2011). This is typical of research examining the effectiveness of weight loss interventions that target samples classified as either overweight (Gardner & Hausenblas, 2004; Rowley, Daniel, Skinner, Skinner, White, & O'Dea, 2000; Slentz et al., 2005) or obese (Appel et al., 2011; Lien et al., 2009; Silva et al., 2010). Greater reductions in BMI are found when obese individuals are the focal cohort (i.e., weight losses representing at least 5% of initial body weight) compared to those who are overweight (Stubbs et al., 2011). It should be noted that existing weight loss interventions rarely include participants classified as normal weight based on BMI values. Given the nature of the

recruitment process and consistent with our ethics application, individuals who were classified as being of "normal" weight according to BMI were not excluded. As such, 20% (n = 8) of the present sample had BMI values within the 'normal' range.

Participants in the present investigation may also differ from those typically recruited in weight loss interventions with respect to PA levels. Within the intervention condition, 88% of the participants (n = 37) reported being physically active enough to obtain health benefits with 81% (n = 34) reporting enough MVPA to contribute both to health and fitness benefits (Godin, 2011). This is in stark contrast to the majority of weight loss research utilizing MVPA in middle-aged samples with most interventions examining individuals classified as sedentary (Rowley et al., 2000; Slentz et al., 2005; Stubbs & Lavin, 2013) or low levels of MVPA behaviour at baseline (Gardner & Hausenblas, 2004; Lien et al., 2009; Silva et al., 2010).

Lastly, when we examined the present sample with regard to exercise motives at baseline we note the majority of the participants reported their exercise behaviour aligned with more autonomous motives. PA interventions that align with SDT (Deci & Ryan, 2002) and measure behavioural regulation towards exercise, report similar findings (Duncan et al., 2010; Silva et al., 2010; Teixeira et al., 2012a). As the participants were members of a commercial fitness centre and the bulk sufficiently active enough to be obtaining health and fitness benefits, it was not surprising that greater endorsement of autonomous regulations were reported (Duncan et al., 2010; Silva et al., 2010).

The Effect of PA and Dietary Interventions on Weight Loss

Weight loss in the overweight and obese is of particular importance considering the effect of excess weight on the incidence of many 'lifestyle diseases' and the resulting burden on health care resources (Stubbs et al., 2012). Determining the most effective

behavioural strategies required for weight loss remains elusive (Wu et al., 2008) although it appears a combination of dietary changes and increased PA is required (Stubbs & Lavin, 2013). Adopting strategies to increase MVPA and improve healthy dietary practices, the present study offered an evidence-informed approach to target weight loss.

Our findings show that a modest decrease in BMI was noted in both conditions of the present investigation. Although many interventions report a weight loss in the intervention condition and a weight gain or maintenance in the control condition (Greaves et al., 2011; Powell et al., 2007) it is not completely novel to report a decrease in both (Diabetes Prevention Program Research Group, 2002; Tuomilehto et al., 2001; Waters, St. George, Chey, & Bauman, 2012). An examination of BMI scores by condition in the present investigation suggest the intervention condition lost their weight primarily during the weight loss challenge whereas the control group lost weight primarily during the follow-up.

The intervention condition's modest weight loss and subsequent partial regain is consistent with intervention research (Cook & Schoeller, 2011; Stubbs & Lavin, 2013). However, the weight loss reported in the control group may have been an artifact of the control group experience, i.e., a response to the measurement process, diffusion of treatment, or the participant's awareness of being involved in an experimental trial (Waters et al., 2012). Although individuals in the control condition did not enroll in the weight loss challenge, at baseline, 89.10% of them indicated they would like to weigh less and therefore, they may have been engaged in efforts to lose weight as well. The weight loss in the intervention condition over the course of the 12 week weight loss challenge was modest (Shaw et al., 2006) and fell below the average reported weight loss in the literature (Shaw et al., 2006). The majority of weight loss interventions that

incorporated increased PA, improved dietary habits and lasted three months or more, reported an average reduction in BMI of 0.4 kg/m^2 (Shaw et al., 2006) with greater weight loss reported in interventions lasting six months or longer (Sharma, 2007). It should be noted that a weight loss of 5-10% is associated with significant improvements in health risk status and generally considered a success by healthcare practitioners (Stubbs et al., 2011). Although the average reduction of BMI within the intervention condition was 0.64 kg/m^2 and therefore, greater than the average reported weight loss (Sharma, 2007), at approximately 2% of overall body weight lost (1.9 kg or 4.18 lbs. per person), it fell short of being enough to effect health risk status.

The lower than expected decrease in BMI may be the result of one of potentially several factors. Although the present investigation targeted an intensity and duration of MVPA that has been shown to be associated with weight losses of 5-7.5 kg (Donnelly et al., 2009), the present sample was already quite active and increased MVPA was not reported. As most weight loss interventions examine the effectiveness of MVPA in previously sedentary individuals (Rowley et al., 2000; Slentz et al., 2005; Stubbs & Lavin, 2013), greater weight loss success may lie more in the differential between previous and newly adopted MVPA behaviours than in the absolute amount of MVPA. Sustained adequate MVPA may confer the benefits of weight-loss maintenance or prevention of weight gain as opposed to weight loss (Cook & Schoeller, 2011; Stubbs & Lavin, 2013).

The concept of exercise non-responders has been noted in the weight loss intervention research (Boutcher & Dunn, 2009; Cook & Schoeller, 2011; King et al.; 2009). The most likely potential causes are a concomitant decrease in incidental, non-exercise PA, an increase in sedentary behaviour and/or an increase in appetite or caloric

intake as a result of the increased MVPA (Boutcher & Dunn, 2009; Colley, Hills, King & Byrne, 2010; Cook & Schoeller, 2011; Thomas et al., 2012). Colley et al. (2010) have suggested that PA interventions should include strategies to maintain incidental PA to counter the switch in PA behaviours that may occur. A comprehensive review examining why individuals do not lose more weight in PA interventions also found that the higher the intensity of the prescribed PA, the greater the increased dietary intake (Thomas et al., 2012). Other factors that can impede weight loss have also been identified in the research including, but not limited to, an individual's personal history of weight loss and weight gain, sleep quality and quantity, and hormonal, genetic and metabolic differences (Boutcher & Dunn, 2009; Cook & Schoeller, 2011). Although the present study did not query specific history of weight loss and weight regain, at baseline, 97.60% of the intervention condition reported having tried to lose weight in the past with 73.80% reporting having tried within the last year. Of those indicating they have a history of weight loss/gain, 28.60% reported having used a weight loss program including previous weight loss challenges held at the same commercial fitness centre.

The Effect of PA Interventions on PA

Contrary to the study hypothesis and MVPA intervention research (Belanger-Gravel et al., 2010; Greaves et al., 2011), a significant increase in MVPA was not reported in the intervention condition at any time point in the present study. Several potential explanations for this could be considered. Firstly, the lack of increased MVPA over the course of the 12 week weight loss challenge, may be reflective of the initial self-reported levels of MVPA. On average, participants in the present study, regardless of condition, reported being physically active enough to obtain both health and fitness benefits (Godin, 2011). This suggests a potential "ceiling effect", in which the

participants may have been maintaining but not increasing an already adequate amount of MVPA (Brownson et al., 2000; Kerr et al., 2010). Interestingly, emerging evidence suggests that performing adequate amounts of MVPA may have a stronger impact on weight-loss maintenance than weight loss itself (Stubbs & Lavin, 2013) and therefore, the MVPA performed in this study may have served to maintain the participant's weights as opposed to effect a loss. A review of interventions designed to increase MVPA in adults found that studies with participants classified as active prior to the intervention also reported lower effect sizes than those with previously sedentary participants (Conn et al., 2011).

Another explanation for the lack of increased MVPA may be a misrepresentation of MVPA behaviour. Being members of a commercial fitness centre, the social desirability to report higher levels of MVPA may have resulted in a bias (Shephard, 2003; Waters et al., 2012). It has also been noted in the research that 'gym-goers' may overestimate their self-reported PA if they report the time spent at the gym versus the time spent exercising (Shephard, 2003). It also appears that moderate intensity PA is the most often overestimated PA of the three intensities queried (Valanou, Bamia & Trichopoulou, 2006).

The reported decrease in MVPA in the control condition from baseline to Time 1 and then the reported increase in MVPA from Time 1 to Time 2 may potentially be explained by resentful demoralization whereby the control condition participants may have felt deprived of the intervention treatment and became discouraged (Onghena, 2005). The most common result of resentful demoralization is the effect of the intervention treatment gets inflated, making the intervention appear more effective than it is (Onghena, 2005). The resentful demoralization effect may have been blunted by the fact that the two

groups were not randomly assigned and therefore, the control condition always had the option of the treatment (by registering and paying for the Challenge).

Lastly, adherence to the amount and/or intensity of the exercise prescribed may have been lower than the self-report measures captured. Exercise adherence rates are difficult to accurately measure and it has been reported that interventions targeting previously sedentary individuals have low-to-moderate adherence rates (Linke, Gallo & Norman, 2011). Although our sample was considered active at baseline, it is likely that greater adherence to the amount and intensity of exercise recommended during the intervention was obtained but not likely 100%. The intensity of the exercise prescribed has been shown to effect adherence with higher intensities of exercise prescribed resulting in decreased adherence and overall lower volume of exercise (Perri et al., 2002). Interesting, it has also been noted that overweight and obese individuals respond to imposed exercise intensity differently than normal weight individuals and report greater displeasure and less adherence when intensity is even 10% greater than what they would self-select (Ekkekakis & Lind, 2006). As the sample in the present investigation was already active, higher intensity and greater duration were the two components of exercise prescription specifically targeted to effect a weight loss response. Together, the combined effect of being previously active individuals performing adequate amounts of MVPA (Stubbs & Lavin, 2013) may have blunted the effect of the weight loss intervention on BMI.

The Effect of the Challenge on Behavioural Regulations for Exercise

Greater endorsement of autonomous motives have been linked to sustained activity (Ryan et al., 2008) which highlights the importance of motivation as an outcome of interest in intervention research. As applied to exercise settings, more autonomous

behavioural regulations are consistently found to be positive predictors of exercise behaviour adoption and maintenance (Teixeira et al., 2012a; Wilson et al., 2003) and weight loss (Palmeira et al., 2007). As hypothesized, a positive (albeit not always statistically significant) association was seen between individuals reporting more autonomous regulation for exercise and greater MVPA. A corresponding negative association was generally found between BMI and more autonomous forms of motivation. However, the nature of the BMI-motivation relationship rarely attained statistical significance when examined over time with a corresponding negative association with weight loss nor was the increased autonomous exercise regulation fully sustained in the long-term.

As previously noted, when exercise motives and weight loss were examined cross-sectionally, a generally negative (albeit non-significant) relationship between BMI and autonomous regulations was found in the intervention condition with a similar, but more often significant, relationship between these variables in the control condition. Change scores indicate a significant negative relationship between identified and integrated regulations with BMI in the intervention group from baseline to Time 1 and between BMI and intrinsic regulation from baseline to Time 2 in the control condition. Our results are supportive of previous research (Silva et al., 2010; Teixeira et al., 2006) that has found exercise intrinsic motivation to be positively associated with weight loss. Silva et al. (2010) found that approximately 42% of their reported weight loss was mediated indirectly by autonomous regulation of exercise. While other potential mechanisms may effect weight control including improved psychological health (Teixeira et al., 2006) or a motivational "spill-over" to autonomous eating self-regulation (Mata et al., 2009), it is

clear that increasing autonomous regulation for exercise may convey multiple benefits for weight control.

Consistent with previous research (Teixeira et al., 2012a), our bivariate correlational analyses showed that identified regulation was the most strongly associated regulation with MVPA in the intervention condition over all three time points. Identified regulation reflects the importance or value that an individual places on the activity or behaviour (Deci & Ryan, 2002). It has been hypothesized by Edmunds et al. (2006) that participation in a behaviour that is strenuous or difficult would need to be considered important by the participant. Identified regulation has consistently been demonstrated to be the strongest predictor of physical activity behaviour (Wilson, Sabiston, Mack & Blanchard, 2012) including PA intervention studies (Edmunds et al., 2006; Rahman, Thogerson-Ntoumani, Thatcher & Doust, 2011; Wilson et al., 2003). When change scores are considered in the present investigation, an increase in PA was positively associated with an increase in identified regulation in the intervention condition both during the weight loss challenge as well as over the entire length of the investigation. Interestingly, in the control condition, a similar pattern of a moderately correlated cross-sectional positive relationship existed between PA and identified regulation, however, change scores indicate increased PA was only associated with greater importance or value in this group from baseline to Time 1. A possible explanation for the association of identified regulation may be that participation in PA behaviours can require organization and planning and therefore may be undertaken more often by individuals who consider it important as opposed to interesting and enjoyable (Edmunds et al., 2006). This observation has lead some researchers to question whether it makes more sense to cultivate identified regulation rather than intrinsic to effect greater MVPA participation

(Edmunds et al., 2006).

A research outcome of the present investigation was to examine the motivational mechanisms underpinning changes in weight loss and MVPA resulting from participation in a weight loss challenge at a commercial fitness centre. There was a significant main effect of time for extrinsic regulation and a significant main effect of condition for introjected regulation. Further, the significant interaction term for integrated and intrinsic exercise regulation noted for those enrolled in the weight loss challenge condition as a result of the intervention, is aligned with previous research (Silva et al., 2010).

Participants, regardless of condition, reported reductions in external regulation across the 12 week intervention period consistent with being less controlled by rewards or the threat of external punishments (Deci & Ryan, 2008). The above is despite the competitive nature of attaining the reward for those in the intervention condition. Based on findings from the present study, it appears as though individuals were not participating in the study to obtain an outcome separable from the activity itself such as a reward or to avoid punishment. The decrease in their endorsement of external regulation may be reflective of a shift in motives from the more controlled outcome of weight loss to a greater endorsement of the value and significance of exercise. And although external regulation has been shown to positively regulate exercise behaviours as it may act as a catalyst of short-term change (Deci & Ryan, 2002), sustained behaviour requires behavioural engagement aligned with more autonomous motives (Wilson et al., 2008).

Of note was that participants in the intervention condition reported greater regulations for exercise consistent with introjected regulation when compared to the controls across the 12 week weight loss challenge. Reasons for the higher introjected regulation scores across the duration of the study are speculative, however Silva et al.

(2010) suggested that interventions may induce increased feelings of consistent self-esteem preservation or reductions in guilt consistent with introjected regulation. As such, individuals enrolled in the weight loss intervention may have done so in an attempt to gain self-approval. With introjected regulation identified as a controlling form of motivation (Deci & Ryan, 2002), researchers have suggested it is an essential precursor to the process of internalization and is associated with short-term behavioural persistence (Deci, Eghrari, Patrick, & Leone, 2004; Pelletier, Fortier, Vallerand, & Briere, 2001; Vansteenkiste, Soenens, & Vandereycken, 2005). Interpretation of the pattern of relationships based on change scores in the present investigation for those in the weight loss challenge support the assertion that increased regulations for exercise linked to introjection are associated with increased MVPA. As such, introjected regulation may be adaptive to the promotion of PA and may co-exist with more autonomous regulations in the short-term to promote behaviour change.

Consistent with previous research, the intervention condition in the present study reported higher levels of integrated and intrinsic exercise regulation post intervention than the control group (Silva et al., 2010). As hypothesized, the observed increases in integrated and intrinsic regulation in the intervention group during the weight loss challenge may be indicative of the internalization of more autonomous motives towards exercise. Previous research utilizing SDT-based (Deci & Ryan, 2002) interventions have noted similar increases in autonomous motivation (Fortier, Duda, Guerin & Teixeira, 2012; Silva et al., 2010). However, contrary to our results, the increase in autonomous exercise motives noted in the Silva et al. (2010) intervention were accompanied by an increase in PA behaviours. Differences in sample characteristics and study design between our investigation and Silva et al. (2010) may account for the differences noted

between autonomous motives and PA behaviour. Aside from their findings that exercise intrinsic motivation was a strong predictor of behaviour change, Silva et al. (2010) also found that intervention-related changes in intrinsic motivation could predict 3-year weight control.

Ryan and Deci (2008) posit the internalization of regulation of change is more important than the change itself, "it is integration within personality rather than behaviour change per se that is the aim of the SDT-approach…" (p.188). As such, it appears as though participation in the weight loss challenge may have been able to facilitate the internalization and integration of more autonomous forms of motivation. With regard to long-term weight maintenance, Teixeira et al. (2010) have advocated that interventions must be effective in promoting exercise intrinsic motivation (Teixeira et al., 2010) as intrinsic motivation predicts PA maintenance. Consideration of change scores across the six months spanning this study highlight the importance of intrinsic motivation on MVPA regardless of condition.

The Effect of Financial Incentives on Weight Loss and Motivation

The use of financial incentives as a strategy to motivate weight loss or behaviour change is not uncommon in the literature although their effectiveness remains equivocal (Burns et al., 2012; Moller et al., 2012). The present study adopted a somewhat unique approach to the provision of incentives. Instead of all participants receiving rewards for achieving targets for weight loss or behavioural change, the present study incorporated a financial incentive to the three individuals that lost the most weight during the 12 week weight loss challenge. The incentive, or prize, was advertised prior to the start of the challenge, but the exact amount was not as it was contingent on the number of participants. Therefore, the individuals in the weight loss challenge were unaware of the

prize until the challenge was completed[3]. The prizes offered did not exceed or cover the cost of the weight loss challenge.

The inability of the intervention condition to sustain their modest weight loss post intervention is consistent with previous research examining the effects of financial incentives on weight loss and weight loss maintenance (Moller et al., 2012; Paloyo, Reichart, Reinermann, & Tauchmann, 2011; Paul-Ebhohimhen & Avenell, 2007). A proposed mechanism of action of financial incentives on weight loss by behavioural economists is that the incentive may essentially bridge the gap between the short term "cost" of healthy eating and increased physical activity (behaviour) and the long term "benefit" of losing weight and improving health (outcome), therefore, increasing the saliency of the benefits of the behaviours required for weight loss (Downs & Lowenstein, 2011; Paloyo et al., 2011). This need to bridge the gap between behaviours and outcomes may also explain why once the incentive is removed, the behaviours are not sustained. Research by Moller et al. (2012) found the provision of a financial incentive predicted a steeper weight regain across the maintenance period and therefore, the incentive may provide a possible explanation for the weight regain noted in the present study.

With regard to behavioural motivation, it has been noted by Deci et al. (1999) that a financial incentive represents an extrinsic or more controlled form of behavioural regulation which may negatively impact the internalization of the more autonomous forms of regulation required for sustainable behaviour change (Deci et al., 1999; Hagger & Chatzisarantis, 2008). In support of their hypothesis, the intervention condition in the present study initially reported a greater amount of controlled (introjected) regulation towards exercise, which may be reflective of the financial incentive that was offered to them. However, contrary to theoretical suppositions and study hypothesis, a significant

increase in more autonomous motives was reported in the intervention condition during the intervention and was partially sustained upon follow-up. A possible explanation for this may be that the participants in the present study did not interpret the reward as being controlling of their behaviour. If individuals believe that a performance-contingent reward conveys positive information about their own competencies and self-control over their results, the controlling effects of the reward can be negated (Deci et al., 1999). As well, if the reward is administered within a social context that is not deemed to be demanding and/or controlling, the effect of the reward on intrinsic motivation can also be buffered (Deci et al., 1999). In the end, extrinsic rewards can be awarded in such a way that they have no (or minimal) detrimental effect on intrinsic motivation.

Therefore, consistent with the current literature on the use of financial incentives (Moller et al., 2012), the prize offered to the intervention group may have encouraged greater weight loss during the 12 week challenge but did not support the sustainability of the weight loss. It also appears to have had minimal effect on exercise motives as noted increases in autonomous regulation were observed in both conditions and scores above baseline were maintained in the intervention condition.

Consideration of the Fitness Centre Setting

Although it has been reported as a growing trend to offer weight loss programming in commercial fitness centres (Thompson, 2011, Tucker et al., 2004), very little research to date has been published using this setting. Estimates suggest that 95% of people who seek to lose weight do so outside the realm of clinical treatments programs (Stubbs et al., 2011) and yet, the majority of the research informing weight loss interventions is coming from university settings or clinical programs (Stubbs et al., 2012). Inherent differences in the characteristics of samples may render results of clinical

treatment programs less generalizable to those seeking to lose weight outside of obesity clinics (Stubbs et al., 2011). Clinical samples are more likely to differ from other overweight/obese persons with regard to their degree of obesity, their propensity to be binge eaters and their psychopathology potentially resulting in a conservative bias (Stubbs et al., 2012). When examining the effectiveness of weight loss interventions in commercial fitness centres, the lack of research coupled with differing results leaves the conclusion still equivocal. One four-week weight loss intervention performed within a commercial fitness centre, reported a greater weight loss than the present study (Gardner & Hausenblas, 2004). Although their sample reported a lower BMI at baseline (M_{BMI} = 28.37) they also initially reported less MVPA (LTEQ M_{METS} = 28.5) and their dietary intervention involved greater caloric restriction for the first two weeks (Gardner & Hausenblas, 2004). Another intervention conducted in a commercial fitness centre on previously sedentary African-American women, reported a modest weight loss post intervention that was not sustained during follow-up (Yancey et al., 2006). And lastly, a wellness challenge designed to effect weight loss and glycemic control in patients living with Type II diabetes and conducted within a commercial fitness centre, reported substantial weight loss (M = 15.9 lbs) over a 5.5 month challenge (Tucker et al., 2004). However, it should be noted, a substantial financial reward ($3,000 for first place) was utilized and the study did not measure the sustainability of the weight loss. The authors of the study, primary care physicians and nurses; did attribute some of the success of their intervention to the commercial fitness centre setting and recommended a greater alignment between primary care and commercial fitness centres in the treatment of obesity and chronic disease (Tucker et al., 2004).

The Inability to Sustain Change

Consistent with the weight loss intervention research the weight loss reported during the intervention in the present investigation was not fully sustained when measured 14 weeks later (Cook & Schoeller, 2011; Stubbs & Lavin, 2013). It should be noted that the intervention was not designed to sustain weight loss but instead to promote weight loss. This differentiation is important as it appears that successful weight loss and successful weight loss maintenance may require two different sets of practices (Sciamanna et al., 2011). Of the 36 weight loss practices surveyed by Sciamanna et al. (2011), only 22% were associated with weight loss and weight loss maintenance. This research may help explain why many weight loss interventions do not report successful weight loss maintenance (Stubbs et al., 2011) and may also suggest that separate interventions or staged interventions focusing on different behaviours would be required to improve maintenance. Unfortunately though, clear identification of the behaviours important for successful weight maintenance are still unknown as reflected by the considerable discrepancy noted in the research (Nakade et al., 2012).

One proposed mechanism to facilitate lasting behaviour change and weight control is the internalization of the regulation of the relevant behaviours resulting in greater self-determination (Teixeira et al., 2012b). However, the increase in autonomous behavioural regulation for exercise was not fully sustained by the intervention condition when measured at six months. Although the intervention was not designed to facilitate the internalization process, but instead to document the changes in behavioural regulation that may have helped to explain any measured behaviour changes, the intervention did effect behavioural regulation positively. It is hypothesized that if an individual's social environment satisfies and fosters the psychological needs of autonomy, competence and relatedness, the process of internalization will be facilitated (Fortier et al., 2012; Ryan et

al., 2008). The fitness professionals conducting the present challenge were not specifically coached to satisfy these psychological needs, however, by providing a supportive social environment, they may have fulfilled these psychological needs. However, the internalization was not fully sustained once the intervention ended. Rahman et al. (2011) utilized SDT (Deci & Ryan, 2002) as a similar theoretical framework for their PA intervention and also reported an increase in autonomous regulation that was not fully sustained at their six month follow up. Even studies experimentally manipulated to implement strategies designed to facilitate the satisfaction of the three psychological needs, report decreases in autonomous regulations gains post intervention (Silva et al., 2011). It has also been noted that need satisfaction is not actualized solely through the social environment but also through the way the environment interacts with the individual (Silva et al., 2011). Therefore, it stands to reason that a change in environment (end of intervention) may affect an individual and the change could affect individuals differently.

Limitations

Several limitations may have influenced study findings and should be recognized and noted. One limitation may have been study design. The quasi-experimental design of the present investigation was intended to capture the effects of a 12 week weight loss challenge in those individuals that self-selected to participate. However, the lack of randomization may have resulted in selection bias (Cawley & Price, 2012). While there were minimally statistically significant differences between conditions at baseline, those enrolled in the intervention condition may have differed from those in the control on variables that were not measured in the present investigation which may have influenced study outcomes.

Another limitation may have been the use of self-report measures for behavioural

regulations for exercise and PA. As participation in the study was voluntary and our sample was already physically active, their responses with regard to exercise motives may not be indicative of the general public. Self-report instruments are common assessment tools to assess MVPA behaviours. However, certain limitations have been identified with their use including: recall bias, item misinterpretation and/or deliberate misrepresentation of information (Duncan et al., 2010; Prince et al., 2008; Shephard, 2003). Prince et al. (2008) found that self-report measures produced both higher and lower measured levels of PA than direct measures. They also found that self-report measures appear to estimate greater amounts of higher intensity (vigorous) PA than low to moderate. As the present study looked to capture primarily MVPA, the effect on the data may have been appreciable (Prince et al., 2008). It has also been noted that self-report measures do not accurately assess intensity (Duncan et al., 2010). As members of a commercial fitness centre, social desirability bias and an exaggeration of duration (i.e., including time spent changing, speaking to other members) may have also affected some of the responses (Shephard, 2003). Future research examining the effectiveness of weight loss interventions in commercial fitness centres should consider using a more direct method of measuring PA. Furthermore, another limitation may have been our decision to measure only moderate and vigorous activity as opposed to light or even incidental. As no increase in MVPA was captured and yet weight loss was observed, other forms of PA (incidental, non-exercise PA) may have contributed to the observed weight loss. Despite limitations, a gold standard for measuring PA does not currently exist and self-report measures are considered an acceptable means of assessing PA behaviour (Welk, 2002). Finally, although self-report will likely continue to be the dominant choice for assessing motivation, complementary approaches (e.g., observer assessments) can and should be

employed in future work to validate self-report measures.

The time of year the study was conducted may have also been a limitation. The weight loss challenge began January 9 with the initial measurement session occurring over the two days prior. An increase in MVPA potentially inspired by any New Year's resolutions may have been captured by the LTEQ as participants were asked to report their MVPA for the previous 7 days. This may have resulted in a greater than usual self-reported amount of MVPA and may not have accurately reflected the "usual" amount of MVPA for the participant. It could also be suggested that the intervention participants held off on increasing their MVPA as they were about to begin a 12 week challenge thereby capturing a greater increase in the control participants.

Another potential limitation may have been our sample size. With 37 participants in the intervention condition and 40 participants in the control condition, the size of the sample may have resulted in an under-powered investigation. The sample size for this study was not only contingent upon individuals self-selecting to participate but also on their willingness to pay for the weight loss challenge. In an attempt to offset this limitation, interpretation of effect size data was included where appropriate.

Lastly, a final limitation of the study was that the participants were not representative of the majority for whom a weight loss intervention is intended given that 17 of the individuals were of normal weight (8 in the intervention condition and 9 in the control condition) and overall, the participants were quite active. Initial weight and initial BMI have been shown to predict greater absolute weight loss (Stubbs et al., 2011). Participation in the weight loss challenge was open to all members of the fitness centre, including those that may have been excluded from participating in a weight loss intervention in a more clinical setting, therefore; making a comparison of results across

all interventions inappropriate.

Future Directions

It has been reported that the majority of individuals looking to lose weight are doing so independent of clinical programs and settings (Stubbs et al., 2012). With commercial fitness centres increasingly offering this type of programming (Thompson, 2011), future research of weight loss interventions in commercial fitness centres is warranted. Such research may help inform best practices for fitness practitioners and may prove to be a viable avenue of obesity treatment and prevention.

This study was not intentionally designed to facilitate motivation for exercise behaviour however, an increase in internalization and integration was observed (i.e., increased integrated and intrinsic). Recognizing that increasing a participant's autonomy may be as important as their weight loss (Teixeira et al., 2012b), future research may want to adopt SDT (Deci & Ryan, 2002) supportive principles (i.e., participant support of basic psychological needs) in the commercial fitness centre setting to effect change in PA behaviours and inform weight loss interventions (Haggar & Chatzisarantis, 2008). Fitness professionals have been identified as having a potentially pivotal role in the internalization process for fitness centre members (Rodgers & Loitz, 2009) and therefore, greater awareness of SDT (Deci & Ryan, 2002) strategies could help them motivate their clients to maintain exercise behaviours. Specifically, considering the predictive effect of identified regulation on PA behaviours, fitness professionals that could better facilitate the alignment of PA benefits to their clients' values may improve PA participation and adherence.

Different behaviours may be required for weight loss versus weight loss maintenance (Sciamanna et al., 2011; Stubbs et al., 2011). Future research utilizing interventions that specifically target either weight loss or weight loss maintenance through different behavioural pathways (i.e., dietary intake, duration and intensity of PA, sleep) may also help improve the sustainability of weight loss as well as a better understanding of the mechanisms behind both outcomes (i.e., weight loss vs. weight maintenance).

Conclusion

In conclusion, this study was one of very few to study the effectiveness of weight loss interventions on weight loss and increased MVPA in commercial fitness centres. Results of the present investigation suggest that weight loss interventions in these settings may be more effective as a means of preventing weight gain than a means of weight loss. Components of the intervention appeared to have supported the internalization process of exercise behavioural regulation and therefore, further research utilizing these components is warranted. As definitive and effective methods of weight loss remain elusive, the contribution this study makes to the evidence base is to document the weight loss successes and failures of a small sample of individuals participating in a rapidly growing programmatic offering in the community setting.

Endnotes

1. Although the intervention employed in the current study focused on both LTPA and dietary consumption, LTPA was selected as the focus of the study.

2. The nutrition component followed the guidelines set forth by Precision Nutrition™ and advocated dietary behavioural change to include eating slower, stopping when 80% full, consuming vegetables and protein with each meal and ensuring a healthy consumption of dietary fat. These recommendations are similar to those included in Canada's Guide to Healthy Eating.

3. The first place winner, won $150.00 cash and a gift basket worth approximately $100.00; the second place winner won $100 and a smaller gift basket worth approximately $50.00 and the third place winner won a one month membership valued at $120.

4. The twelve weekly assigned healthy behaviours disseminated to the intervention participants by the Personal Trainer/Nutrition Coach were:

    1. Consume fish oil (1g per 1% of body fat for first 14 days and half that amount afterwards) and a multivitamin every day.
    2. Accumulate 5 hours (or as close as is reasonably possible, in any increment) of exercise per week.
    3. Eat slower and stop when 80% full.
    4. Perform one cardiovascular interval session per week.
    5. Consume at least one serving of vegetable at every meal and snack.

6. Within reported exercise minutes, ensure ½ of the minutes are from cardiovascular training and 1/2 are from resistance training.

7. Consume one portion of lean protein at every meal.

8. Perform a type of exercise that is different from your regular routine each week.

9. Eat less refined and processed carbohydrates and if fat loss is your goal consume them only within the 1-2 hours after exercise.

10. Adopt the principle of progressive overload to your workouts and make continual changes to program.

11. Eat at least 4 times per day and ideally, every 3 hours.

12. Set a long-term goal centered around physical activity and share it with your Trainer.

5. Topics covered in the educational seminars included: Healthy Nutrition, Maximizing your Exercise Results and Managing Stress to Better Manage your Weight. The healthy cooking demonstration topics included: Cooking with Healthy Fats, Using Alternative Grains and Cooking with Greens.

References

Appel, L. J., Clark, J. M., Hsin-Chieh, Y., Yeh, H. C., Wang, N. Y., Coughlin, J. W., …Brancati, F. L. (2011). Comparative effectiveness of weight-loss interventions in clinical practice. *The New England Journal of Medicine, 365*, 1959-1968. doi:10.1056/NEJMoa1108660

Belanger-Gravel, A., Godin, G., Vezina-Im, L. A., Amireault, S., & Poirier, P. (2010). The effect of theory-based interventions on physical activity participation among overweight/obese individuals: a systematic review. *Obesity Reviews,* 12, 430-439. doi:10.1111/j.1467-789X.2010.00729.x

Blair, S. N., LaMonte, M. J., & Nichaman, M. Z. (2004). The evolution of physical activity recommendations: how much is enough? *American Journal of Clinical Nutrition, 79,* 913S-920S.

Blissmer, B., Riebe, D., Dye, G., Ruggiero, L., Greene, G., & Caldwell, M. (2006). Health-related quality of life following a clinical weight loss intervention among overweight and obese adults: intervention and 24 month follow-up effects. *Health and Quality of Life Outcomes, 4*. doi:10.1186/1477-7525-4-43

Bouchard, C., Blair, S. N., & Haskell, W. L. (2007). *Physical activity and health*. Champaign, Ill,: Human Kinetics.

Boutcher, S. H., & Dunn, S. L. (2009). Factors that may impede the weight loss response to exercise-based interventions. *Obesity Reviews, 10,* 671-680. doi:10.1111/j.1467-789X.2009.00621.x

Brownson, R. C., Housemann, R. A., Brown, D. R., Jackson-Thompson, J., King, A. C., Malone, B. R., & Sallis, J. F. (2000). Promoting physical activity in rural communities: Walking trail access, use and effect. *American Journal of Preventative Medicine, 18*. doi:10.1016/S0749-3797(99)00165-8

Bryan, S. N., & Katzmarzyk, P. T. (2009). Estimating leisure-time physical activity energy expenditure in the Canadian population: a comparison of 2 methods. *Applied Physiology, Nutrition and Metabolism, 34*, 666-672. doi:10.1139/H09-054

Burns, R. J., Donovan, A. S., Ackermann, R. T., Finch, E. A., Rothman, A. J., & Jeffery, R. W. (2012). A theoretically grounded systematic review of material incentives for weight loss: Implications for interventions. *Annals of Behavioral Medicine*. doi:10.1007/s12160-012-9403-4

Bush, M., & Kirkpatrick, S. (2003). Setting dietary guidance: the Canadian experience. *Journal of the American Dietetic Association, 103*, 22-27. doi:10.1016/j.jada.2003.09.033

Canadian Society of Exercise Physiology (2010). The Canadian physical activity, fitness and lifestyle approach; supplement to the third edition. Retrieved June 17, 2013, from http://www.csep.ca/cmfiles/certifications/cpaflainsert/CPAFLA-3rd-Edition-Insert-Package-August-2010.pdf.

Canadian Society of Exercise Physiology (2011). Canadian Physical Activity Guidelines. Retrieved June 22, 2012, from http://www.csep.ca/CMFiles/Guidelines/

PAGuidelinesGlossary_E.pdf.

Cattenaci, V. A., & Wyatt, H. R. (2007). The role of physical activity in producing and maintaining weight loss. *Nature Clinical Practice Endocrinology and Metabolism, 3*, 518- 529. doi:10.1038/ncpendmet0554

Cawley, J., & Price, J. A. (2012). Financial incentives for weight loss: Results from a workplace wellness program. Retrieved September 7, 2012, from http://www.sociology.uci.edu/files/economics/docs/micro/s12/cawley.pdf.

Chaput, J. P., Klingenberg, L., Rosenkilde, M., Gilbert, J. A., Tremblay, A., & Sjodin, A. (2011). Physical activity plays an important role in body weight regulation. *Journal of Obesity,* 2011. doi:10.1155/2011/360257

Chaput, J. P., & Sharma, A. M. (2011). Is physical activity in weight management more about 'calories in' than 'calories out'? *British Journal of Nutrition, 106*, 1768-1769. doi:10.1017/S0007114511002844

Cohen, J. (1988). *Statistical power analyses for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Colley, R. C., Hills, A. P., King, N. A., & Byrne, N. M. (2010). Exercise-induced energy expenditure: Implications for exercise prescription and obesity. *Patient Education and Counseling, 79,* 327-332. doi:10.1016/j.pec.2010.03.001

Colley, R. C., Garriguet, D., Janssen, I., Craig, C. L., Clarke, J., & Tremblay, M. S. (2011). Physical activity of Canadian adults: Accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. *Statistics Canada Health Reports, 22*.

Conn, V. S., Hafdahl, A. R., & Mehr, D. R. (2011). Interventions to increase physical

activity among healthy adults: Meta-analysis of outcomes. *American Journal of Public Health, 101*, 751-758. doi:10.2105/AJPH.2010.194381

Cook, C. M., & Schoeller, D. A. (2011). Physical activity and weight control: conflicting findings. *Current Opinion in Clinical Nutrition and Metabolic Care, 14*, 419-424. doi:10.1097/MCO.0b013e328349b9ff

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16,* 297-234.

Daniel, W. W. (2005). *Biostatistics: A foundation for analysis in the health sciences* (8th ed.). New York, NY: Wiley.

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: the self-determination theory perspective. *Journal of Personality,* 62, 119-142.

Deci, E. L., Ryan, R. M., & Koestner, R. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*, 627-668. doi:10.1037/0033-2909.125.6.627

Deci, E. L., & Ryan, R. M. (2002). *Handbook of Self-Determination Research*. Rochester, NY: University of Rochester Press.

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development and health. *Canadian Psychology,* 1, 182-185. doi: 10.1037/a0012801

Diabetes Prevention Program Research Group (2002). Reduction in the incidence of Type 2 Diabetes with lifestyle interventions or metformin. *New England Journal of Medicine, 346,* 393-403.

DiClemente, C. C., & Prochaska, J. O. (1998). Toward a comprehensive, transtheoretical model of change: Stages of change and addictive behaviors. In W. R. Miller (Ed.) & N. Heather (Ed.), *Applied clinical psychology: Treating addictive behaviors*. New York, NY: Plenium Press.

Donnelly, J. E., Blair, S. N., Jakicic, J. M., Manore, M. M., Rankin, J. W., & Smith, B. K. (2009). Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *American College of Sports Medicine,* 459-471. doi:10.1249/MSS.0b013e3181949333

Downs, J. S., & Loewenstein, G. (2011). Behavioural Economics and Obesity. In John Cawley (Ed.), *The Oxford Handbook of the Social Science of Obesity*. Oxford University Press: New York.

Duncan, L. R., Hall. C. R., Wilson, P. M., & Jenny, O. (2010). Exercise motivation: a cross-sectional analysis examining its relationships with frequency, intensity and, duration of exercise. *International Journal of Behavioural Nutrition and Physical Activity, 7*. doi:10.1186/1479-5868-7-7

Edmunds, J., Ntoumanis, N., & Duda, J. L. (2006). A test of self-determination theory in the exercise domain. *Journal of Applied Social Psychology, 36*, 2240-2265. doi:10.1111/j.0021-9029.2006.00102.x

Edmunds, J., Ntoumanis, N., & Duda, J. L. (2007). Adherence and well-being in overweight and obese patients referred to an exercise on prescription scheme: A self-determination theory perspective. *Psychology of Sport and Exercise, 8,* 722-740. doi:10.1016/j.psychsport.2006.07.006

Ekkekakis, P., & Lind, E. (2006). Exercise does not feel the same when you are overweight: the impact of self-selected and imposed intensity on affect and exertion. *International Journal of Obesity*, *30*, 652-660. doi:10.1038/sj.ijo.0803052

Fjeldsoe, B., Neuhas, M., Winkler, E., & Eakin, E. (2011). Systematic review of maintenance of behaviour change following physical activity and dietary interventions. *Health Psychology*, *30*, 99-109. doi:10.1037/a0021974

Fortier, M. S., Duda, J. L., Guerin, E., & Teixeira, P. J. (2012). Promoting physical activity: development and testing of self-determination theory-based interventions. *International Journal of Behavioural Nutrition and Physical Activity, 9*. doi:10.1186/1479-5868-9-20

Gardner, R. E., & Hausenblas , H. A. (2004). Understanding exercise and diet motivation in overweight women enrolled in a weight-loss program: A prospective study using the theory of planned behavior. *Journal of Applied Social Psychology*, *34*, 1353-1370. doi:10.1111/j.1559-1816.2004.tb02010.x

Glass, G. V., & Hopkins, K. D. (1996). *Statistical methods in psychology and education* (3rd ed.) Needham Heights, MA: Allyn & Bacon.

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., & Schwarz, P. (2011). Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health, 11*. doi:10.1186/1471-2458-11-119

Grissom, R. J., & Kim, J. J. (2005). *Effect sizes for research: A broad practical approach*.

Lawrence Erlbaum Associates: Mahwah, New Jersey.

Godin, G. (2011). Commentary: The Godin-Shephard Leisure-Time Physical Activity Questionnaire. *Health & Fitness Journal of Canada, 4*, 18-22.

Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behaviour in the community. *Canadian Journal of Applied Sports Sciences, 10*, 141-146.

Haggar, M., & Chatzisarantis, N. (2008). Self-determination theory and the psychology of exercise. *International review of Sport and Exercise Psychology 1*, 79-103. doi:10.10801/17509840701827437

Haggar, M. S., Keatley, D. A., Chan, D. C. K., Chatzisarantis, N. L. D., Dimmock, J. A., Jackson, B., & Ntoumanis, N. (2013). The goose is (half) cooked: A consideration of the mechanisms and interpersonal context is needed to elucidate the effects of personal financial incentives on health behaviour. *International Journal of Behavioral Medicine, 20,* 114-120. doi:10.1007/s12529-013-9317-y

Hankey, C. R. (2010). Session 3 (Joint with the British Dietetic Association): Management of obesity weight loss-interventions in the treatment of obesity. *Proceedings of the Nutrition Society, 69,* 34-38. doi:10.1017/S0029665109991844

Hays, N. P., Starling, R. D., Liu, X., Sullivan, D. H., Trappe, T. A., Fluckey, J. D., & Evans, W. J. (2004). Effects of an ad libitum low-fat, high-carbohydrate diet on body weight, body composition, and fat distribution in older men and women. *Archives of Internal Medicine, 164,* 210-217. doi:10.1001/archinte.164.2.210

Hill, J. O., Wyatt, H. R., & Peters, J. C. (2012). Energy balance and obesity. *Circulation, 126,* 126-132. doi:10.1161./circulationaha.111.087213

Jacobs Jr., D. R., Ainsworth, B. E., Hartman, T. J., & Leon, A. S. (1992). A simultaneous

evaluation of 10 commonly used physical activity questionnaires. *Medicine and Science in Sports and Exercise, 25,* 81-91.

Jakicic, J. M., Marcus, B. H., Gallagher, K. I., Napolitano, M., & Lang, W. (2003). Effect of exercise duration and intensity on weight loss in overweight, sedentary women: A randomized trial. *Journal of the American Medical Association, 290*, 1323-1330. doi:10.1001/jama.290.10.1323

Jakicic, J. M. (2009). The effect of physical activity on body weight. *Obesity, 17*(3), 34-38. doi:10.1038/oby.2009.386

Jeffery, R. W. (2012). Financial incentives and weight control. *Preventative Medicine, 55*,61-67. doi:10.1016/j.ypmed.2011.12.024

Jeffery, R. W., Wing, R. R., Sherwood, N. E., & Tate, D. F. (2003). Physical activity and weight loss: does prescribing higher physical activity goals improve outcome? *American Journal of Clinical Nutrition, 78*, 684-689.

Jeffery, R. W., Wing, R. R., Thorson, C., & Burton, L. R. (1998). Use of personal trainers and financial incentives to increase exercise in a behavioral weight-loss program. *Journal of Consulting and Clinical Psychology, 66*, 777-783. doi:10.1037/0022-006X.66.5.777

Jolly, K., Lewis, A., Beach, J., Denley, J., Adab, P., Deeks, J. J., Daley, A., & Aveyard, P. (2011). Comparison of range of commercial or primary care led weight reduction programmes with minimal intervention control for weight loss in obesity: Lighten Up randomized controlled trial. *British Medical Journal 2011, 343*. doi:10.1136/bmj.d6500

Karvinen, K. H., Raedeke, T. D., Arastu, H., & Allison, R. R. (2011). Exercise programming and counseling preferences of breast cancer survivors during or

after radiation therapy. *Oncology Nursing Forum, 38*, 326-334. doi:10.1188/11.ONF.E326-E334

Kerr, J., Norman, G. J., Adams, M. A., Ryan, S., Frank, L., Sallis, J. F.,Calfas, K. J., & Patrick, K. (2010). Do neighbourhood environments moderate the effect of physical activity lifestyle interventions in adults? *Health Place, 16*, 903-908. doi:10.1016%2Fj.healthplace.2010.05.002

King, N. A., Hopkins, M., Caudwell, P., Stubbs, R. J., & Blundell, J. E. (2009). Beneficial effects of exercise: shifting the focus from body weight to other markers of health. *British Journal of Sports Medicine, 43*, 924-927. doi:10.1136/bjsm.2009.065557

Kraemer, W. J., Volek, J. S., Clark, K. L., Gordon, S. E., Incledon, T., Puhl, S. M., Triplett-McBride, N. T., McBride, J. M., Putukian, M., & Sebastianelli, W. J. (1997). Physiological adaptations to a weight-loss dietary regimen and exercise programs in women. *Journal of Applied Physiology, 83*, 270-279.

Lang, A., & Froelicher, E. S. (2006). Management of overweight and obesity in adults: behavioural intervention for long-term weight loss and maintenance. *European Journal of Cardiovascular Nursing, 5*, 102-114. doi:10.1016/j-ejenurse.2005.11.002

Lien, L. F., Haqq, A. M., Arlotto, M., Slentz, C. A., Muehlbauer, M. J., McMahon, R. L.,…Svetkey, L. P. (2009). The STEDMAN project: Biophysical, biochemical and metabolic effects of a behavioural weight loss intervention during weight loss, maintenance, and regain. *A Journal of Integrative Biology, 13*, 21-35. doi:10.1089/omi.2008.0035

Linke, S. E., Gallo, L. C., & Norman, G. J. (2011). Attrition and adherence rates of sustained vs. intermittent exercise interventions. *Annals of Behavioral Medicine,* 42, 197-209. doi: 10.1007/s12160-011-9279-8

Lynagh, M. C., Sanson-Fisher, R. W., & Bonevski, B. (2011). What's good for the goose is good for the gander. Guiding principles for the use of financial incentives in health behaviour change. *International Journal of Behavioural Medicine, 20*, 114-20. doi:10.1007/s12529-011-9202-5

Markland, D. (2009). The mediating role of behavioural regulations in the relationship between perceived body size discrepancies and physical activity among adult women. *Hellenic Journal of Psychology*, 6, 169-182.

Markland, D., & Tobin, V. (2004). A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport & Exercise Psychology, 26,* 191-196.

Mata, J., Silva, M. N., Vieira, P. N., Carraca, E. V., Andrade, A. M., Coutinho, S. R., Sardinha, L. B., & Teixeira, P. J. (2009). Motivational "spill-over" during weight control: Increased self-determination and exercise intrinsic motivation predict eating self-regulation. *Health Psychology, 28*, 709-716. doi:10.1037/a0016764

Michie, S., Abraham, C., Whittington, C., McAteer, J., & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: a meta-regression. *Health Psychology, 28*, 690-701. doi:10.1037/a0016136

Moller, A. C., McFadden, H. G., Hedeker, D., & Spring, B. (2012). Financial motivation undermines maintenance in an intensive diet and activity intervention. *Journal of Obesity 2012*. doi:10.1155/2012/740519

Morgan, P. J., Warren, J. M., Lubans, D. R., Collins, C. E., & Callister, R. (2011).

Engaging men in weight loss: Experiences of men who participated in the male only SHED-IT pilot study. *Obesity Research & Clinical Practice, 5,* 239-248. doi:10.1016/j.orcp.2011.03.002

Mullan, E., & Markland, D. (1997). Variations in self-determination across the stages of change for exercise in adults. *Motivation and Emotion, 21*, 349-362.

Nakade, M., Aiba, N., Morita, A., Miyachi, M., Sasaki, S., & Watenabe, S. (2012). What behaviors are important for successful weight maintenance? *Journal of Obesity, 2012*. doi:10.1155/2012/202037

Ohkawara, K., Tanaka, S., Miyachi, M., Ishikawa-Takata, K., & Tabata, I. (2007). A dose-response relation between aerobic exercise and visceral fat reduction: systematic review of clinical trials. *International Journal of Obesity, 31,* 1786-1797. doi:10.1038/sj.ijo.0803683

Onghena, P. (2005). Resentful demoralization. In B. S. Everitt & D. Howell (Eds.), *Encyclopedia of Statistics in Behavioural Science*. Oxford, UK: John Wiley & Sons, Ltd.

Paloyo, A., Reichart, A. R., Reinermann, H., & Tauchmann, H. (2011). The causal link between financial incentives and weight loss: An evidence-based survey of the literature. *Journal of Economic Surveys*. doi: 10.1111/joes.12010

Paul-Ebhohimhen, V., & Avenell, A. (2007). Systematic review of the use of financial incentives in treatments for obesity and overweight. *Obesity Reviews, 9,* 355-367. doi:10.1111/j.1467-789X.2007.00409.x

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Briere, N. M. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, 25, 279-306.

Perri, M. G., Anton, S. D., Durning, P. E., Ketterson, T. U., Sydeman, S. J., Berlant, N. E.,…Martin, A. D. (2002). Adherence to exercise prescriptions: Effects of prescribing moderate versus higher levels of intensity and frequency. *Health Psychology, 21*, 452-458. doi:10.1037/0278-6133.21.5.452

Powell, L. H., Calvin III, J. E., & Calvin Jr., J. E. (2007). Effective obesity treatments. *American Psychologist, 62*, 234-246. doi:10.1037/0003-066X.62.3.234

Prince, S. A., Adamo, K. B., Hamel., M. E., Hardt, J., Connor Gorber, S., & Tremblay, M. (2008). A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. *International Journal of Behavioral Nutrition and Physcial Activity, 5*, 56. doi:10.1186/1479-5868-5-56

Prochaska, J. O., Velicer, W. F., Rossi, J.S., Goldstein, M. G., Marcus, B. H., Rakowski, W.,…Rossi, S. R. (1994). Stages of change and decisional balance for 12 problem behaviors. *Health Psychology,* 1, 39-46.

Public Health Agency of Canada (2011). Obesity in Canada. A joint report from the Public Health Agency of Canada and the Canadian Institute for Health Information. Retrieved June 15, 2012, from http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/oic-oac/assets/pdf/oic-oac-eng.pdf.

Rahman, R. J., Thogerson-Ntoumani, C., Thatcher, J., & Doust, J. (2011). Changes in need satisfaction and motivation orientation as predictors of psychological and behavioural outcomes in exercise referral. *Psychology of Health 26*, 1521-1539. doi:10.1080/08870446.2010.538849

Rhodes, R. E., Courneya, K. S., Blanchard, C. M., & Plotnikoff, R. C. (2007). Prediction of leisure-time walking: an integration of social cognitive, perceived environmental, and personality factors. *International Journal of Behavioral Nutrition and Physical Activity*, 4, doi:10.1186/1479-5868-4-51.

Rodgers, W. M., & Loitz, C. C. (2009). The role of motivation in behaviour change: How do we encourage our clients to be active? *ACSM's Health & Fitness Journal, 13*, 7-12. doi:10.1249/FIT.0b013e3181916d11.

Rowley, K. G., Daniel, M., Skinner, K., Skinner, M., White, G. A., & O'Dea, K. (2000). Effectiveness of a community-directed 'healthy lifestyle' program in a remote Australian Aboriginal community. *Australian and New Zealand Journal of Public Health, 24*, 136-144. doi:10.1111/j.1467-842X.2000.tb00133.x

Ryan, R. M., Patrick, H., Deci, E. L., & Williams, G. C. (2008). Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. *The European Health Psychologist, 10*, 2-5.

Ryan, R. M., & Deci, E. L. (2008). A self-determination theory approach to psychotherapy: The motivational basis for effective change. *Canadian Psychology, 49*, 186-193. doi:10.1037/a0012753

Saris, W. H. M., Blair, S. N., van Baak, M. A., Eaton, S. B., Davies, P. S. W., Di Pietro,…Wyatt, H. (2003). How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st stock conference and consensus statement. *Obesity Reviews, 4,* 101-114. doi:10.1046/j.1467-789X.2003.00101.x

Schwartz, B. (2009). Incentives, choice, education and well-being. *Oxford Review of*

Education, 35, 391-403. doi:10.1080/03054980902934993

Schwartz, M. B., Chambliss, H. O., Brownell, K. D. Blair, S. N., & Billington, C. (2003). Weight bias among health professionals specializing in obesity. *Obesity Research, 11*, 1033-1039. doi:10.1038/oby.2003.142

Sciamanna, C. N., Kiernan, M., Rolls, B. J., Boan, J., Stuckey, H. Kephart, D.,…Dellasega, C. (2011). Practices associated with weight loss versus weight-loss maintenance: results of a national survey. *American Journal of Preventive Medicine, 41*, 159-166. doi:10.1016/j.amepre.2011.04.009

Sharma, M. (2007). Behavioural interventions for preventing and treating obesity in adults. *Obesity Reviews, 8*, 441-449. doi:10.1111/j.1467-789X.2007.00351.x

Shaw, K. A., Gennat, H. C., O'Rourke, P., & Del Mar, C. (2006). Exercise for overweight or obesity. *Cochrane Database of Systematic Reviews, 4*. doi:10.1002/14651858.CD003817.pub3.

Shephard, R. J. (2003). Limits to the measurement of habitual physical activity by questionnaires. *British Journal of Sports Medicine, 37*, 197-206.

Silva, M. N., Vieira, P. N., Coutinho, S. R., Minderico, C. S., Matos, M. G., Sardinha, L. B., & Teixeira, P. J. (2010). Using self-determination theory to promote physical activity and weight control: a randomized controlled trial in women. *Journal of Behavioral Medicine, 33*, 110-122. doi:10.1007/s10865-009-9239-y

Silva, M. N., Markland, D., Carraca, E. V., Vieira, P. N., Coutinho, S. R., Minderico, C.S.,…Teixeira, P. J. (2011). Exercise autonomous motivation predicts 3-yr weight loss in women. *Medicine and Science in Sports and Exercise*, 728-737. doi:10.1249/MSS.0b013e3181f3818f

Slentz, C. A., Aiken, L. B., Houmard, J. A., Bales, C. W., Johnson, J. L., Tanner, C. J.,…Kraus, W. E. (2005). Inactivity, exercise and visceral fat. STRRIDE: a randomized, controlled study of exercise intensity and amount. *Journal of Applied Physiology*, *99,* 1613-1618. doi:10.1152/japplphysiol.00124.2005

Statistics Canada (2012). Physical activity during leisure time, 2011. Retrieved May 27, 2013 from http://www.statcan.gc.ca/pub/82-625-x/2012001/article/11667-eng.htm.

Stubbs, J., Whybrow, S., Teixeira, P., Blundell, J., Lawton, C., Westenhoefer, J.,…Raats, M. (2011). Problems in identifying predictors and correlates of weight loss and maintenance: implications for weight control therapies based on behaviour change. *Obesity Reviews, 12,* 688-708. doi:10.1111/j.1467-789X.2011.00883.x

Stubbs, J., Brogelli, D., Pallister, C., Avery, A., McConnon, A., & Lavin, J. (2012). Behavioural and motivational factors associated with weight loss and maintenance in a commercial weight management programme. *The Open Obesity Journal, 2012*, 35-43.

Stubbs, R. J., & Lavin, J. H. (2013). The challenges of implementing behaviour changes that lead to sustained weight management. *Nutrition Bulletin, 5,* 5-22. doi:10.1111/nbu.12002

Teixeira, P. J., Going, S. B., Houtkooper, L. B., Cussler, E. C., Metcalfe, L. L., Blew, R. M., ... & Lohman, T. G. (2006). Exercise motivation, eating, and body image variables as predictors of weight control. *Medicine and Science in Sports and Exercise*, *38*(1), 179. doi: 10.1249/01.mss.0000180906.10445.8d

Teixeira, P. J., Silva, M. N., Coutinho, S. R., Palmeira, A. L., Mata, J., Vieira, P.

N.,…Sarinha, L. B. (2010). Mediators of weight loss and weight loss maintenance in middle-aged women. *Obesity, 18,* 725-735. doi:10.1038/oby.2009.281

Teixeira, P. J., Carraca, E. V., Markland, D. A., Silva, M. N., & Ryan, R. M. (2012a). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behaviural Nutrition and Physical Activity, 9*. doi:10.1186/1479-5868-9-78

Teixeira, P. J., Silva, M. N., Mata, J., Palmeira, A. L., & Markland, D. (2012b). Motivation, self-determination and long-term weight control. *International Journal of Behavioral Nutrition and Physical Activity, 9*, 1-13.

Thomas, D. M., Bouchard, C., Church, T., Slentz, C., Kraus, W. E., Redman, L. M.,…Heymsfield, S. B. (2012). Why do individuals not lose more weight from an exercise intervention at a defined dose? An energy balance analysis. *Obesity Reviews, 13,* 835-847. doi:10.1111/j.1467-789X.2012.01012.x

Thompson, W. R. (2011). Fitness trends for 2012. *ACSM's Health & Fitness Journal, 15*, 9-18.

Trinh, L., Plotnikoff, R. C., Rhodes, R., North, S., & Courneya, K. S. (2011). Associations between physical activity and quality of life in a population-based sample of kidney cancer survivors. *Cancer, Epidemiology, Biomarkers and Prevention, 20*, 859. doi:10.1158/1055-9965.EPI-10-1319

Tucker, R. M., May, C., Bennett, R., Hymer, J., & McHaney, B. (2004). A gym-based wellness challenge for people with Type 2 diabetes: Effect on weight loss, body composition, and glycemic control. *Diabetes Spectrum, 17*, 176-180. doi:10.2337/diaspect.17.3.176

Tuomilehto, J., Lindstrom, J., Eriksson, J. G., Valle, T. T., Hamalainen, H., Ilanne-Parikka, P.,…Uusitupa, M. (2001). Prevention of Type 2 Diabetes Mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *The New England Journal of Medicine, 344*, 1343-1350. Retrieved from http://search.proquest.com/docview/223948163?accountid=9744.

Valanou, E. M., Bamia, C., & Trichopoulou, A. (2006). Methodology of physical-activity and energy-expenditure assessment: a review. *Journal of Public Health, 14*, 58-65. doi:10.1007/s10389-006-0021-0

van Aggel-Leijssen, D. P., Saris, W. H., Hul, G. B., & van Baak, M. A. (2002). Long-term effects of low-intensity exercise training on fat metabolism in weight-reduced obese men. *Metabolism, 51*, 1003-1010. doi:10.1053/meta.2002.34028

Vansteenkiste, M., Soenens, B., & Vandereycken, W. (2005). Motivation to change in eating disorder patients: a conceptual clarification on the basis of self-determination theory. *International Journal of Eating Disorders*, 37, 207-219. doi:10.1002/eat.20099

van Tuyckom, C., & Scheerder, J. (2010). A multilevel analysis of social stratification patterns of leisure-time physical activity among Europeans. *Science & Sports, 25*, 304-311. doi:10.1016/j.scispo.2010.04.003

Volpp, K. G., John, L. K., Troxel., A. B., Norton, L., Fassbender, J., & Loewenstein, G. (2008). Financial incentive-based approaches for weight loss: a randomized trial. *The Journal of the American Medical Association, 300*, 2631-2637. doi:10.1001/jama.2008.804

Warburton, D. E. R., Katzmarzyk, P. T., Rhodes, R. E., & Shephard, R. J. (2007). Evidence-informed physical activity guidelines for Canadian adults. *Applied Physiology, Nutrition and Metabolism, 32*, 16-68. doi:10.1139/H07-123

Waters, L., St. George, A., Chey, T., & Bauman, A. (2012). Weight change in control group participants in behavioural weight loss interventions: a systematic review and meta-regression study. *BMC Medical Research Methodology, 12*. doi:10.1186/1471-2288-12-120

Welk, G. J. (2002). *Physical Activity assessments for health-related research*. Champaign, IL: Human Kinetics.

Wilson, P. M., Mack, D. E., Gunnell, K. E., Gregson, J. P., Cheung, S., Rimmer S., & Sylvester, B. D. (2011). Assessing leisure-time exercise questionnaire: Normative values, gender differences, and non-response error. *Annals of Behavioral Medicine*, *39*, 188.

Wilson, P. M., Mack, D. E., & Grattan, K. P. (2008). Understanding motivation for exercise: A self-determination theory perspective. *Canadian Psychology*, *49*, 250-256. doi:10.1037/a0012762

Wilson, P. M., & Rodgers, W. M. (2004). The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women. *Psychology of Sport and Exercise*, 5, 229-242, doi:10.1016/S1469-0292(03)00003-7.

Wilson, P. M., Rodgers, W. M., Loitz, C. C., & Scime, G. (2006). "It's who I am…really!" The importance of integrated regulation in exercise contexts. *Journal of Applied Biobehavioral Research, 11*, 79-104. doi:10.1111/j.1751-

9861.2006.tb00021.x

Wilson, P. M., Rodgers, W. M., Blanchard, C. M., & Gessel, J. (2003). The relationship between psychological needs, self-determined motivation, exercise attitudes, and physical fitness. *Journal of Applied Social Psychology, 33*(11), 2373-2392. doi:10.1111/j.1559-1816.2003.tb01890.x

Wilson, P. M., Sabiston, C. M., Mack, D. E., & Blanchard, C. M. (2012). On the nature and function of scoring protocols used in exercise motivation research: An empirical study of the behavioural regulation in exercise questionnaire. *Psychology of Sport and Exercise, 13,* 614-622. doi:10.1016/j.psychsport.2012.03.009

World Health Organization (2009). Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks (WHO Press, Geneva).

World Health Organization (2013). Global Strategy on Diet, Physical Activity and Health. Retrieved June 25, 2013, from http://www.who.int/dietphysicalactivity/physical_activity_intensity/en/index.html

Wu, T., Gao, X., Chen, M., & van Dam, R. M. (2008). Long-term effectiveness of diet-plus-exercise interventions vs. diet-only interventions for weight loss: a meta-analysis. *Obesity Reviews, 10,* 313-323. doi:10.1111/j.1467-789X.2008.00547.x

Yancey, A. K., McCarthy, W. J., Harrison, G. G., Wong, W. K., Siegel, J. M., & Leslie, J. (2006). Challenges in improving fitness: Results of a community-based, randomized, controlled lifestyle change intervention. *Journal of Women's Health, 15*, 412-429. doi:10.1089/jwh.2006.15.412

Zumbo, B. D. (2007). Validity: Foundational issues and statistical methodology. In: C. R.

Rao, & S. Sinharay (Eds.), *Handbook of Statistics, volume 26: Psychometrics*. Amsterdam: Elsevier

Table 1

Baseline Demographic and Lifestyle Descriptive Statistics

	Intervention (n = 42)		Control (n = 46)				
Variable	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
Age	45.21	7.54	46.69	9.72	-0.79	0.43	-0.17
	%		%		χ2	*p*	phi
Gender							
Male	16.70		30.40				
Female	83.30		69.60				
Marital Status					3.40	0.33	0.02
Married/Common Law	71.40		73.30				
Widowed	0.00		4.40				
Separated/Divorced	11.90		4.40				
Single/Never Married	16.70		17.80				
Ethnic Origin					0.13	0.94	0.00
Aboriginal	0.00		0.00				
African	0.00		0.00				
Asian	2.40		2.20				
Caucasian/White	92.90		91.30				
Other	4.80		6.50				
Education					2.04	0.36	0.02
High School Diploma	16.70		8.90				
University/College degree	59.50		73.30				
Graduate Degree	23.80		17.80				
Employment					7.25	0.13	0.03

Full-Time	69.00	82.20			
Part-Time	26.20	6.70			
Unemployed	2.40	2.20			
Retired	2.40	8.90			
Health Condition					
Type ½ Diabetes			0.92	0.34	0.01
Yes	0.00	2.20			
No	100.00	97.80			
Cancer			0.00	0.95	0.00
Yes	2.40	2.20			
No	97.60	97.80			
Heart Disease			1.87	0.17	0.02
Yes	0.00	4.30			
No	100.00	95.70			
Osteoporosis			0.00	0.95	0.00
Yes	2.40	2.20			
No	97.60	97.80			
Do you consider yourself to be…			1.31	0.25	0.01
Overweight	85.70	76.10			
Underweight	0.00	0.00			
Right Weight	14.30	23.90			
Would you like to weigh…			5.83	0.05	0.03
More	2.40	0.00			
Less	97.60	89.10			
Same	0.00	10.90			
Have you ever tried to lose weight?			0.87	0.35	0.01
Yes	97.60	93.50			
No	2.40	6.50			

If yes, during the last 12 months?			1.62	0.20	0.01
Yes	73.80	84.80			
No	26.20	15.20			
If yes, did you seek help from…					
Personal Trainer?			2.06	0.15	0.02
Yes	59.50	73.90			
No	40.50	26.10			
Dietitian?			0.37	0.54	0.00
Yes	7.10	10.90			
No	92.90	89.10			
Nutritionist?			0.04	0.83	0.00
Yes	9.50	10.90			
No	90.50	89.10			
Doctor?			1.63	0.20	0.01
Yes	2.40	8.70			
No	97.60	91.30			
Other health professional?			0.68	0.41	0.01
Yes	14.30	8.70			
No	85.70	91.30			
Weight Loss Program?			2.31	0.13	0.02
Yes	28.60	15.20			
No	71.40	84.80			
SOC – PA			0.35	0.15	0.01
Regularly exercising > than 6 months	50.00	63.10			
Regularly exercising < than 6 months	11.90	15.20			
Intend to within next 30	35.70	15.20			

days		
Intend to within next 6 months	2.40	6.50

Note. *M* = mean; *SD* = standard deviation; *t* = *t*-test statistic; *p* = significance of *t*-test statistic; *d* = effect size (Cohen, 1988); phi = phi coefficient (Grissom & Kim, 2005). SOC-PA = Stage of Change for Physical Activity (Prochaska et al., 1994).

Table 2

Mean Difference in Study Variables Between Intervention and Control Conditions at Baseline

	Intervention $n = 42$		Control $n = 46$				
Variable	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
Anthropometric and Body Composition Measures							
BMI	29.70	8.74	29.98	5.19	0.46	0.64	0.11
Body fat %	35.70	6.75	33.09	6.40	1.28	0.20	0.27
WC*	99.65	17.30	96.21	14.63	0.99	0.32	0.21
MVPA							
LTEQ-MVPA	40.64	21.04	46.20	25.92	-1.10	0.27	-0.24
BREQ-2R							
Extrinsic Regulation	0.83	1.17	0.61	0.75	0.65	0.52	0.22
Introjected Regulation	2.60	1.13	1.88	1.33	2.53	0.01	0.58
Identified Regulation	3.42	0.74	3.35	0.82	-0.21	0.84	0.09
Integrated Regulation	2.88	0.99	3.00	1.14	-1.15	0.25	-0.11
Intrinsic Regulation	2.74	0.93	3.12	1.02	-1.72	0.09	-0.39

Note. *M* = mean; *SD* = standard deviation; *t* = t-test statistic; *p* = significance of t-test statistic; *d* = effect size (Cohen, 1988); phi = phi coefficient (Grissom & Kim, 2005). MVPA = Moderate-to-Vigorous Physical Activity; LTEQ – Godin Leisure Time Exercise Questionnaire. BREQ-2R = Behavioural Regulation in Exercise Questionnaire.

Table 3

Cronbach's α Reliability Statistics for each BREQ-2R Subscale at each Time Point

	Time 1	Time 2	Time 3
Extrinsic	0.84	0.87	0.89
Introjected	0.89	0.90	0.85
Identified	0.84	0.83	0.87
Integrated	0.92	0.90	0.92
Intrinsic	0.91	0.94	0.94

Table 4

Pearson Bivariate Correlations between Study Variables by Condition at Baseline

Construct	1	2	3	4	5	6	7	8	9
1. BMI	--	.89**	.54	.31*	.13	-.35**	-.28*	-.35**	-.28*
2. Waist Circumference	.89**	--	.42**	.38**	-.01	-.38**	-.32*	-.32*	-.30*
3. Body fat %	.54**	.50**	--	.06	.17	-.10	-.03	-.20	-.14
4. Extrinsic Regulation	.16	.19	-.04	--	.32*	-.31*	-.27*	-.47**	-.28*
5. Introjected Regulation	-.12	-.08	-.14	.48**	--	.21	.22	-.01	-.11
6. Identified Regulation	-.28*	-.22	-.27	.06	.56**	--	.88**	.74**	.44**
7. Integrated Regulation	-.23	-.23	-.39	-.00	.50**	.82**	--	.74**	.46**
8. Intrinsic Regulation	-.20	-.18	-.29	.13	.42**	.68**	.67**	--	.39**
9. LTEQ-MVPA	-.19	-.06	-.09	-.01	.01	.46**	.42**	.37**	--

Note. Lower diagonal values are for the intervention condition (n = 42); upper diagonal values are for the control condition (n = 46).
LTEQ = Godin Leisure Time Exercise Questionnaire; MVPA = Moderate-to-Vigorous Physical Activity.
**Correlation is significant at the 0.01 level (one-tailed).* Correlation is significant at the 0.05 level (one-tailed).

Table 5

Pearson Bivariate Correlations between Study Variables by Condition at Time 1

Construct	1	2	3	4	5	6	7	8	9
1. BMI	--	.88**	.57**	.36**	.12	-.30*	-.35*	-.35*	-.28*
2. Waist Circumference	-.13	--	.43**	.35*	-.01	-.34*	-.36**	-.23	-.24
3. Body fat %	.56**	-.10	--	.13	.11	-.09	-.08	-.26	-.29*
4. Extrinsic Regulation	.28	.12	.02	--	.28*	-.41**	-.46**	-.36**	-.51**
5. Introjected Regulation	-.15	.30*	-.11	.25	--	.17	.08	-.18	.03
6. Identified Regulation	-.15	-.08	-.23	.10	.48**	--	.87**	.61**	.61**
7. Integrated Regulation	-.28	-.02	-.46**	.09	.39*	.87**	--	.66**	.66**
8. Intrinsic Regulation	-.16	-.07	-.14	.01	.29*	.60**	.69**	--	.48**
9. LTEQ-MVPA	-.07	-.11	-.18	.23	.15	.33*	.23	.08	--

Note. Lower diagonal values are for the intervention condition (n = 35); top diagonal values are for the control condition (n = 42).
LTEQ = Godin Leisure Time Exercise Questionnaire. MVPA = Moderate-to-Vigorous Physical Activity.
**Correlation is significant at the 0.01 level (one-tailed). * Correlation is significant at the 0.05 level (one-tailed).

Table 6

Pearson Bivariate Correlations between Study Variables by Condition at Time 2

Construct	1	2	3	4	5	6	7	8	9
1. BMI	--	.87**	.53**	.49**	.31*	-.29*	-.31*	-.40**	-.54**
2. Waist Circumference	.95**	--	.45**	.45**	.15	-.31*	-.36*	-.36*	-.49**
3. Body fat %	.65**	.55**	--	-.03	.16	.05	.02	-.07	-.26
4. Extrinsic Regulation	.20	.23	-.16	--	.42**	-.25	-.31*	-.39**	-.30*
5. Introjected Regulation	.05	.05	.16	.21	--	.28*	.18	-.05	-.05
6. Identified Regulation	-.31*	-.28	-.29*	.12	.30*	--	.85**	.75**	.34*
7. Integrated Regulation	-.26	-.19	-.29*	.14	.25	.90**	--	.86**	.39**
8. Intrinsic Regulation	-.23	-.13	-.18	-.01	.36*	.76**	.77**	--	.45**
9. LTEQ-MVPA	-.39*	-.27	-.34*	.13	.14	.44**	.40*	.33*	--

Note. Lower diagonal values are for the intervention condition (n = 33); upper diagonal values are for the control condition (n = 37).
LTEQ = Godin Leisure Time Exercise Questionnaire; MVPA = Moderate-to-Vigorous Physical Activity.
**Correlation is significant at the 0.01 level (one-tailed). * Correlation is significant at the 0.05 level (one-tailed).

Table 7

Pearson Bivariate Correlations between Standardized Residuals of Study Variables by Condition Baseline-Time 1

Construct	1	2	3	4	5	6	7	8	9
1. BMI	--	.57**	.45**	.21	.05	-.08	-.19	-.14	.03
2. Waist Circumference	.75**	--	.14	-.12	.14	-.05	.08	.16	-.28*
3. Body fat %	.48**	.33*	--	.20	.11	-.04	-.18	-.30*	.04
4. Extrinsic Regulation	-.11	-.18	-.11	--	.20	-.39*	-.64**	-.31*	-.34*
5. Introjected Regulation	-.01	.02	.01	.39**	--	.16	-.10	-.26*	.13
6. Identified Regulation	-.28*	-.17	-.12	.03	.33*	--	.62**	.26*	.38**
7. Integrated Regulation	-.35*	-.37*	-.37*	-.05	.08	.65**	--	.42**	.53**
8. Intrinsic Regulation	-.09	-.21	.14	-.08	.23	.62**	.45**	--	.28*
9. LTEQ-MVPA	-.29*	-.24	-.06	.12	.16	.42**	.28	.25	--

Note. Lower diagonal values are for the intervention condition (n = 42); upper diagonal values are for the control condition (n = 46).
LTEQ = Godin Leisure Time Exercise Questionnaire; MVPA = Moderate-to-Vigorous Physical Activity.
**Correlation is significant at the 0.01 level (one-tailed). * Correlation is significant at the 0.05 level (one-tailed).

Table 8

Pearson Bivariate Correlations between Standardized Residuals of Study Variables by Condition Time 1-Time 2

Construct	1	2	3	4	5	6	7	8	9
1. BMI	--	.48**	.57**	-.12	.09	.20	.03	.10	-.09
2. Waist Circumference	.49**	--	.61**	-.03	-.03	.25	-.04	.05	-.08
3. Body fat %	-.01	.20	--	-.16	.09	.24	-.02	.10	-.03
4. Extrinsic Regulation	.16	.12	-.02	--	.33*	.08	.06	-.02	-.47**
5. Introjected Regulation	.07	.25	.12	.14	--	.19	.08	.07	-.32*
6. Identified Regulation	-.10	-.23	-.02	.23	.16	--	.44**	.55**	.03
7. Integrated Regulation	-.09	-.11	-.00	-.13	.30*	.71**	--	.36*	.06
8. Intrinsic Regulation	-.18	-.02	.10	-.02	.21	.63**	.71**	--	.21
9. LTEQ-MVPA	-.26	.15	.05	.08	-.19	.28	.19	.36*	--

Note. Lower diagonal values are for the intervention condition (n = 35); upper diagonal values are for the control condition (n = 42).
LTEQ = Godin Leisure Time Exercise Questionnaire; MVPA = Moderate-to-Vigorous Physical Activity.
**Correlation is significant at the 0.01 level (one-tailed).* Correlation is significant at the 0.05 level (one-tailed).

Table 9

Pearson Bivariate Correlations between Standardized Residuals of Study Variables by Condition Baseline-Time 2

Construct	1	2	3	4	5	6	7	8	9
1. BMI	--	.48**	.51**	.18	.25	.09	-.10	-.29*	-.22
2. Waist Circumference	.41*	--	.52**	.26	.09	.15	-.09	-.05	-.34*
3. Body fat %	.41**	.44**	--	.16	.16	.14	-.16	-.17	-.17
4. Extrinsic Regulation	.10	-.07	-.05	--	.35*	.08	-.15	-.11	-.21
5. Introjected Regulation	-.02	.15	.41**	.36*	--	.37*	.14	-.03	-.19
6. Identified Regulation	-.14	-.16	.20	.02	.32*	--	.68**	.54**	.06
7. Integrated Regulation	-.21	-.37*	-.01	-.06	.07	.70**	--	.74**	.16
8. Intrinsic Regulation	-.07	.14	.24	-.05	.35*	.76**	.52**	--	.31*
9. LTEQ-MVPA	.01	-.06	.01	.04	.02	.36*	.20	.37*	--

Note. Lower diagonal values are for the intervention condition (n = 33); upper diagonal values are for the control condition (n = 37).
LTEQ = Godin Leisure Time Exercise Questionnaire; MVPA = Moderate-to-Vigorous Physical Activity.
**Correlation is significant at the 0.01 level (one-tailed). * Correlation is significant at the 0.05 level (one-tailed).

Table 10

Analysis of Variance, Means and Standard Deviation for Study Variables

		Baseline		Time 1		Time 2			ANOVA		
		M	*SD*	*M*	*SD*	*M*	*SD*		*F*	*p*	η^2
BMI	Intervention	30.16	7.21	29.52	7.08	29.76	7.32	Time	3.57	.04	.05
	Control	29.42	5.15	29.44	5.21	29.19	5.32	Condition	.10	.76	.00
								Interaction	3.18	.05*	.05
Body Fat	Intervention	34.82	6.70	31.13	7.50	32.56	8.04	Time	20.05	.00	.23
%	Control	34.57	6.22	32.73	7.01	31.85	8.09	Condition	.02	.90	.00
								Interaction	3.25	.04	.05
WC	Intervention	98.90	19.28	97.32	18.91	96.75	20.08	Time	.99	.32	.02
	Control	96.21	14.63	97.77	13.59	95.00	13.83	Condition	.51	.48	.01
								Interaction	.73	.40	.01
LTEQ-	Intervention	42.52	19.35	48.58	16.97	50.24	20.40	Time	.98	.38	.02
MVPA	Control	46.73	16.97	43.81	22.29	46.70	24.60	Condition	.11	.75	.00

								Interaction	1.54	.22	.02
Extrinsic	Intervention	.83	1.17	.51	.79	.39	.62	Time	4.99	.01	.07
Regulation	Control	.61	.75	.40	.66	.54	.84	Condition	.14	.71	.00
								Interaction	1.88	.16	.03
Introjected	Intervention	2.60	1.13	2.25	.98	2.13	.82	Time	2.96	.06	.04
Regulation	Control	1.88	1.33	1.70	1.29	1.78	1.28	Condition	5.21	.03	.07
								Interaction	1.00	.37	.02
Identified	Intervention	3.42	.74	3.54	.58	3.41	.67	Time	1.23	.30	.02
Regulation	Control	3.35	.82	3.32	.82	3.27	.86	Condition	.71	.40	.01
								Interaction	.82	.44	.01
Integrated	Intervention	2.88	.99	3.36	.81	3.08	.90	Time	5.01	.01	.07
Regulation	Control	3.00	1.14	2.99	1.11	2.84	1.21	Condition	.48	.49	.01
								Interaction	4.88	.01	.06
Intrinsic	Intervention	2.74	.93	3.04	.78	2.91	.89	Time	1.31	.27	.02
Regulation	Control	3.12	1.02	3.02	1.10	2.99	1.06	Condition	.44	.51	.01

Interaction	5.00	.01	.07

Note. *M* = mean; *SD* = standard deviation; *F* = *F* statistic; *p* = significance of *F* statistic; η^2 = partial eta squared. LTEQ = Leisure Time Exercise Questionnaire; MVPA = Moderate-to-Vigorous Physical Activity. *indicates a *p* value reported at .05 to remain consistent with APA format but is actually .052.

Appendix A

Research Ethics Clearance Board Letter

Brock University
Research Ethics Office
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Bioscience Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE: 12/15/2011

PRINCIPAL INVESTIGATOR: MACK, Diane E. - Kinesiology

FILE: 11-096 - MACK

TYPE: Masters Thesis/Project STUDENT: Louise Blais
SUPERVISOR: Diane Mack

TITLE: Mechanisms Underpinning Sustained Lifestyle Behaviour Change

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW Expiry Date: 12/31/2012

The Brock University Bioscience Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from 12/15/2011 to 12/15/2011.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 12/15/2011. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Research Ethics web page at http://www.brocku.ca/research/policies-and-forms/research-forms.

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Brian Roy, Chair
Bioscience Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

Appendix B

Recruitment Flyer for Study

Behavioural Health Sciences Research Lab

Study Participants Needed

The Behavioural Health Sciences Research Lab (BHSRL) at Brock University and Louise Blais (Principal Investigator) are currently recruiting for individuals to participate in a 26 week study designed to study the long-term benefits of participation in short-term (12 week) fitness challenges.

Who Can Participate?

Any member at The Club at White Oaks (between the ages of 18-65 years) participating (or not participating) in the January Challenge. There will be two groups in this study - the Challenge group and the Control (not in the Challenge) group.

What's Involved?

Three comprehensive physical assessments (weight, girth, body fat, estimated VO2max, etc.) performed at baseline, the end of the 12 week Challenge and 14 weeks after the Challenge. Participation will also involve completing 7 questionnaires at each measurement point to assess level of motivation, psychological needs and goal content. All Study Participants will be assessed - both the Intervention and the Control groups.

For more information and details, please contact Louise Blais at lblais@whiteoaksresort.com or 905-688-2032 x 5298.
To register for the Challenge (and/or the Study) please see The Club Desk.

Please note, Challenge participants are not required to participate in the study and success in the Challenge will not be affected by participation (or lack of).

Appendix C

Letter of Invitation

Letter of Invitation:

Principal Investigator: Dr. Diane Mack, Associate Professor, Physical Education and Kinesiology
Principal Student Investigator: Louise Blais, BSc. MA Candidate, Brock University

Introduction: This research project is the Masters thesis proposed by Louise Blais, MA Candidate in the Faculty of Applied Health Sciences at Brock University. The investigators currently direct or work in the Behavioural Health Sciences Research Lab which is located in the Faculty of Applied Health Sciences (Welch Hall, Room 142) who have an interest in health promotion.

Purpose: The main purpose of this study is to investigate the role that short-term (12 week) fitness challenges play in changing varied markers of health including fitness, anthropometric/body composition and well-being. The secondary purpose of this study is to investigate the role that variables aligned with Self-Determination Theory play in health behaviour change and the extent to which they are they fulfilled in short-term fitness challenges. Short-term fitness challenges, loosely based on the reality television show "The Biggest Loser" appear to be increasing in popularity as program offerings in commercial fitness clubs. Identifying the effectiveness of these challenges to produce change in the varied markers of health and the sustainability of those changes is both relevant and timely. As well, identifying the role that these challenges play in satisfying the motivational mechanisms of Self-Determination Theory may result in greater long-term health behaviour change.

Involvement: Your involvement would be greatly appreciated and will help to further our understanding of the role short-term fitness challenges play in changing varied markers of health as well as addressing the psychological needs required to regulate behaviour as per the Self-Determination Theory put forth by Deci and Ryan. If you choose to participate in this study, we will ask that you complete eight questionnaires that address motivation, goal setting and well-being as well as undergo a fitness assessment that includes obtaining measurements of resting heart rate (RHR), blood pressure (BP), weight, height, girth measurements, body mass index (BMI), body fat percentage, sub-maximal aerobic fitness test that will estimate V02max, muscular endurance and flexibility. Both the completion of the questionnaires and the physical assessment will be performed at The Club at White Oaks to coincide with the beginning of the fitness challenge and are expected to take approximately one hour to complete in total. If you are participating in the fitness challenge, the physical assessment is identical and therefore, with your consent, those results will be used for this study. Both assessments will repeated 12 weeks later at the end of the fitness challenge and again 20 weeks later at the end of the research study.

Benefits: There are a number of benefits associated with participating in this study. At the end of the study, you will be provided with the physical assessment data collected on you for the entire six months as opposed to only that of the 12 week challenge. As well, you will receive personalized feedback in regards to the psychological assessments completed by you. Each participant may also elect to receive a formal summary of the major research findings presented in aggregate format, with de-identified data upon completion of the study. Indirect benefits may also include, but are not limited to, (a) an increased awareness of your physical activity and eating habits that may be useful to you; (b) an extra physical assessment 20 weeks after the end of the challenge to measure if changes attained during the challenge were maintained or even improved upon; (c) contribution to the improved knowledge and understanding of the effectiveness of fitness challenges from both health and motivation/well-being improvement perspectives; and (d) opportunities to be involved in the research being conducted at Brock University. The study findings will be disseminated in academic journals and conference presentations; however, the specific identity of any participant in the study will not be disclosed in these outlets. Any information that is provided from participants will be treated with confidentiality and access to all information that might

identify participants will be limited to members of the research team only. All recorded data will be kept on a secured internet site and/or in locked filing cabinets accessible only to members of the research team. Consistent with guidelines that control the collection and storage of scientific information in Canada, all data collected for this study will be destroyed five years following the completion of the investigation.

Participation: Participation in this study is voluntary and individuals may decline answering any question(s) that they find invasive, offensive, or inappropriate or participating in any physical measurement that they find unpleasant or painful. There are no known psychological or physical risks associated with participation. You may chose to decline or withdraw your participation at any time throughout the course of the study and will not experience any negative consequences as a result of your decision. Your participation in the challenge will not be affected in any way whatsoever by your participation in the study. Once the data any participant submits as a function of their involvement in this study have been de-identified, they can no longer be removed from the data base upon request. However, your participation is needed and would be appreciated as it will improve the conclusions derived from this investigation. All data provided are not anonymous in nature but will be treated with the utmost confidentiality. All summary reports emanating from this study will use de-identified (i.e., all identifying information will be removed) data only.

Thank you for your interest and involvement in this study.

Sincerely;

Diane Mack, PhD	Louise Blais, BSc.
Associate Professor	Principal Student Investigator
Email: dmack@brocku.ca	Email: lb03vm@brocku.ca
Tel: 905 688 5550 Ext. 4364	Tel: 905 688 2032 Ext. 5298

This project has been reviewed and cleared by the Office of Research Services Ethics Board at Brock University (File # 11-096). Any questions pertaining to your rights as a participant in research at Brock University can be directed to the Research Ethics Officer (reb@brocku.ca or 905 688 5550 Ext. 3035).

Appendix D

Informed Consent

Date: January 2012

Informed Consent

Title of Study: Challenging Weight Loss: The Effectiveness of a 12 Week Weight Loss Challenge on Weight Loss, Physical Activity and Motivation

Principal Investigator: Dr. Diane Mack, Associate Professor, Physical Education and Kinesiology
Principal Student Investigator: Louise Blais, BSc. MA Candidate, Brock University

I understand that I have been asked to participate in a study that involves research and acknowledge each of the following:

- I have received and read the Letter of Information provided to me by the research team conducting this study.
- I understand that participation will involve completing 8 questionnaires that will take approximately 20-30 minutes on a three separate occasions separated by 12-consective weeks.
- I understand that participation will involve completing a fitness assessment that includes obtaining measurements of resting heart rate (RHR), blood pressure (BP), weight, height, girth measurements, body mass index (BMI), body fat percentage, sub-maximal aerobic fitness test that will estimate V02max (to be conducted as a walking test on a treadmill that is stopped once exercise heart rate reaches 75% - this test is suitable for healthy, non-athletic individuals), muscular endurance and flexibility.
- I understand that I can request to have an examiner of my own sex to take my measurements.
- I understand that I can choose to discontinue any measurement at any point throughout the assessment.
- I understand that I can choose to decline participation at any point in time throughout the study.
- I understand that the purpose of this study is to investigate the role that fitness challenges play in changing varied markers of health including fitness, anthropometric/body composition and well-being.
- I understand that no known psychological or physical risks are associated with participation.
- I understand that questions in the questionnaires will request the disclosure of personal information.
- I understand that there is no obligation to answer any question that I feel is invasive, offensive, or inappropriate.
- I understand that members of the research team have secured procedures to ensure participant confidentiality.
- I understand that all personal information will not be provided anonymously but will be kept strictly confidential such that all information will be stored and coded in such a way that personal identification is not possible other than by members of the research team.
- I understand that once I have completed the study, and the research team have collected and linked all of the data I provide to them in the course of this study, that any data I have provided will be de-identified in such a way that it is no longer identifiable to anyone including members of the research team. At this point, I understand that my data cannot be identified by any member of the research team and cannot be removed even at my request.
- I understand that my participation in this study is voluntary and that I may withdraw from the study at any time and for any reason without penalty.
- I understand that only members of the research team named above will have access to the data. Data will be entered on a secured internet site and will be downloaded onto a computer stored in a locked office and filing cabinet at Brock University.
- I understand that data will be destroyed five years following completion of the study (i.e. post-publication).
- I understand that participants may gain a better understanding of the role that structured fitness challenges play in satisfying the psychological needs required to increase their motivation towards long term participation in healthy behaviours as a function of their participation in this study.
- I understand that the results of this study will be distributed in academic journal articles and conference presentations and a summary of the results will be made available to the participants in the study.
- As indicated by my consent below, I acknowledge that I am participating freely and willingly.

I agree to participate in this study described above. I have made this decision based on the information I have read in the Letter of Information and Informed Consent documents. I have had the opportunity to

receive any additional details I wanted about the study and understand that I may ask questions at any point in time in the future. I understand that I may withdraw this consent at any time.

Name (please print):

□ I consent to participate in this study by checking this box Date:

This study has been reviewed and received ethics clearance through the Research Ethics Board at Brock University (File# 11-096). If you have any comments or concerns about your rights as a research participant, please contact the Research Ethics Office at (905) 688-5550 Ext. 3035, reb@brocku.ca.

Appendix E

Physical Activity Readiness Questionnaire (PAR-Q)

Physical Activity Readiness
Questionnaire - PAR-Q
(revised 2002)

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO		
☐	☐	1.	**Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?**
☐	☐	2.	**Do you feel pain in your chest when you do physical activity?**
☐	☐	3.	**In the past month, have you had chest pain when you were not doing physical activity?**
☐	☐	4.	**Do you lose your balance because of dizziness or do you ever lose consciousness?**
☐	☐	5.	**Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?**
☐	☐	6.	**Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?**
☐	☐	7.	**Do you know of any other reason why you should not do physical activity?**

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions →

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT _____ WITNESS _____
or GUARDIAN (for participants under the age of majority)

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

Supported by: Health Canada Santé Canada

continued on other side...

Appendix F

Questionnaire Package

Mechanisms underpinning sustained lifestyle behaviour change

About This Research Study

This confidential questionnaire is to investigate psychological and environmental factors associated with why you eat the foods you choose to consume and why you exercise. There are no right or wrong answers to many of these questions. Please read all questions carefully and answer each one according to what is true for you in your life. This is a very thorough questionnaire. Consequently some questions may appear similar to each other. Please answer each and every question to ensure the accuracy of your data for this study.

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Section 1: This section includes questions designed to describe the people participating in this study. All information received is held in absolute confidence. Please provide your…

Age _____ YEARS

Please check one of the following…

What is your gender?

❑ Male ❑ Female

What is your current marital status?

❑ Married/Common Law ❑ Widowed ❑ Separated/Divorced ❑ Single

What is the highest educational qualification you currently hold?

❑ High School Diploma ❑ University/College Degree ❑ Graduate Degree

What is your current employment status?

❑ Full-Time Employed ❑ Part-Time Employed ❑ Unemployed ❑ Retired

How would you describe your ethnic origin?

❑ Aboriginal ❑ African ❑ Asian ❑ Caucasian ❑ Other

Please indicate with a check mark if you have any of the following health conditions…

Type 1/2 Diabetes

Cancer If so, please specify what. _____

Heart Disease If so, please specify what. _____

Osteoporosis

Section 2: The following questions will be used to describe your weight control history. These questions are intended for descriptive purposes only.

Do you consider yourself to be…
(…please check only one of the following responses)

Overweight ☐	**Underweight** ☐	**About the right weight** ☐

Would you like to weigh…
(…please check only one of the following responses)

More ☐	**Less** ☐	**Stay about the same** ☐

Have you ever (in your life) tried to lose weight?

Yes ☐	**No** ☐

During the past 12 months have you tried to lose weight?

Yes ☐	**No** ☐

In the past 12 months, did you seek help from any of the following health professionals to lose weight? (Please check all that apply to you within the past 12 months only)

Personal Trainer	☐
Dietitian	☐
Nutritionist	☐
Doctor	☐
Other Health Professional	☐
Weight Loss Program (Jenny Craig, Herbal Magic, etc)	☐
No---I have not sought any help for weight loss in the past 12 months	☐

If you checked "Weight Loss Program", please indicate the name of the program (e.g. Jenny Craig, Herbal Magic, Dr. Bernstein, etc) in the space provided:

Section 3: The following statements pertain to your participation in regular exercise. For the purposes of these statements, regular exercise is defined as

- Doing exercise that add up to a total of 30 or more minutes
- Doing exercise that are of moderate or strenuous intensity such that your heart rate and/or breathing rate increase but don't exhaust you
- Doing exercise on 4 or more days of the week

According to the definition provided above, do you participate in regular exercise?

Yes, I **have been** regularly exercising for **more than 6 months**	☐
Yes, I **have been** regularly exercising for **less than 6 months**	☐
No, but **I intend** to participate in regular exercise in the **next 30 days**	☐
No, but **I intend** to participate in regular exercise in the **next 6 months**	☐
No, and I **do not intend** to participate in regular exercise in the **next 6 months**	☐

The following statements pertain to your diet and food choices. For the purposes of these statements, healthy diet is defined as

- Eating lower fat food choices (e.g., vegetables) more frequently than higher fat food (e.g., french fries) choices
- Eating a variety of food for the four major food groups (grain products, milk products, meat and alternative products, and fruit & vegetable products)
- Eating a diet that is considered to be high in fibre

According to the definition provided above, do you regularly eat a healthy diet?

Yes, I **have been** regularly eating a healthy diet for **more than 6 months**	☐
Yes, I **have been** regularly eating a healthy diet for **less than 6 months**	☐
No, but **I intend** to eat a healthy diet in the **next 30 days**	☐
No, but **I intend** to eat a healthy diet in the **next 6 months**	☐
No, and I **do not intend** to eat a healthy diet in the **next 6 months**	☐

Section 4: *The following statements represent different feelings people have when they engage in exercise. Please answer the following questions by considering* ***how you typically feel when you engage in exercise.*** *Use the following scale:*

	False	***Mostly False***	***More False than True***	***More True than False***	***Mostly True***	***True***
1. I feel that I am able to complete exercises that are personally challenging.	1	2	3	4	5	6
2. I feel attached to my exercise companions because they accept me for who I am.	1	2	3	4	5	6
3. I feel like I share a common bond with people who are important to me when we do exercise together.	1	2	3	4	5	6
4. I feel confident I can do even the most challenging exercises.	1	2	3	4	5	6
5. I feel a sense of camaraderie with my exercise companions because we do physical activity for the same reasons.	1	2	3	4	5	6
6. I feel confident in my ability to perform exercises that personally challenge me.	1	2	3	4	5	6
7. I feel close to my exercise companions who appreciate how difficult physical activity can be.	1	2	3	4	5	6
8. I feel free to do exercise in my own way.	1	2	3	4	5	6
9. I feel free to make my own exercise program decisions.	1	2	3	4	5	6
10. I feel capable of completing exercises that are challenging to me.	1	2	3	4	5	6
11. I feel like I am in charge of my exercise program decisions.	1	2	3	4	5	6
12. I feel like I am capable of doing even the most challenging exercises.	1	2	3	4	5	6
13. I feel like I have a say in choosing my exercises that I do.	1	2	3	4	5	6
14. I feel connected to the people who I interact with while we do exercise together.	1	2	3	4	5	6
15 I feel good about the way I am able to complete challenging exercises.	1	2	3	4	5	6
16. I feel like I get along well with other people who I interact with while we do exercise together.	1	2	3	4	5	6

17. I feel free to choose which exercises I participate	1	2	3	4	5	6
18. I feel like I am the one who decides what exercises I do.	1	2	3	4	5	6

Section 5: Why do you exercise? *The following list identifies reasons why people exercise. Please indicate on the scale provided how true each statement is for YOU with (0) = Not true for me and (4) = Very true for me.*

	Not true for me	Sometimes true for me	Moderately true for me	Often true for me	Very true for me
1. I feel like a failure when I haven't exercised in a while.	0	1	2	3	4
2. I get restless if I don't exercise regularly.	0	1	2	3	4
3. I participate in exercise because it has become a fundamental part of who I am.	0	1	2	3	4
4. I exercise because it is consistent with my values.	0	1	2	3	4
5. I think it is important to make the effort to exercise regularly.	0	1	2	3	4
6. I find my exercise a pleasurable activity.	0	1	2	3	4
7. It's important to me to exercise regularly.	0	1	2	3	4
8. I take part in exercise because it is consistent with my life goals.	0	1	2	3	4
9. I consider exercise to be an important part of my identity.	0	1	2	3	4
10. I get pleasure and satisfaction from participating in exercise.	0	1	2	3	4
11. I feel under pressure from my friends/family to exercise.	0	1	2	3	4
12. I exercise because it is fun.	0	1	2	3	4
13. I exercise because other people say I should.	0	1	2	3	4
14. I feel ashamed when I miss an exercise session.	0	1	2	3	4
15. I exercise because others will not be pleased with me if I don't.	0	1	2	3	4
16. I enjoy my exercise sessions.	0	1	2	3	4

17. I feel guilty when I don't exercise.	0	1	2	3	4
18. I take part in exercise because my friends/family/spouse say I should.	0	1	2	3	4
19. I value the benefits of exercise.	0	1	2	3	4

Section 6: *The following questions take into account the environment in which you exercise. Please indicate on the scale provided how true each statement is for YOU with (0) = Not true for me and (4) = Very true for me.* ***The staff at the exercise facility...***

	Not true for me	Sometimes true for me	Moderately true for me	Often true for me	Very true for me
1. Take into account my individual needs.	0	1	2	3	4
2. Give me good advice.	0	1	2	3	4
3. Make time for me even though they are busy.	0	1	2	3	4
4. Provide a range of activities.	0	1	2	3	4
5. Make it clear to me what I need to do to get results.	0	1	2	3	4
6. Make me feel like I matter to them.	0	1	2	3	4
7. Provide me with choices and options.	0	1	2	3	4
8. Make it clear what to expect from engaging in the activities.	0	1	2	3	4
9. Care about me.	0	1	2	3	4
10. Encourage me to take my own initiative.	0	1	2	3	4
11. Give me exercises that are suited to my level.	0	1	2	3	4
12. Are concerned about my well-being.	0	1	2	3	4
13. Consider my personal needs.	0	1	2	3	4
14. Help me to feel confident about exercise.	0	1	2	3	4
15. Look after me well.	0	1	2	3	4

Section 7: The following questions are a number of statements concerning the goals people often have when asked why they eat a healthy diet. *Whether you currently eat healthy or not*, please read each statement carefully and indicate by circling the appropriate number, whether or not each statement *is true* for you personally, *or would be true* for you personally if you did eat healthy. For example, if you do not consider a statement to be true for you at all, circle the '0'. If you think that a statement is very true for you, circle the '5'. Remember, we want to know why *you personally* choose (or might choose) to eat a healthy diet, not whether you think the statements are good reasons for *anybody* to eat healthy.

Personally, I eat healthy (or might eat healthy)...	**Not at all true for me**					**Very true for me**
1. To stay slim	0	1	2	3	4	5
2. To prevent health problems	0	1	2	3	4	5
3. To make new friends	0	1	2	3	4	5
4. To avoid ill-health	0	1	2	3	4	5
5. Because I find eating healthy satisfying in and of itself	0	1	2	3	4	5
6. Because it makes me feel good	0	1	2	3	4	5
7. To release tension	0	1	2	3	4	5
8. To help prevent an illness that runs in my family	0	1	2	3	4	5
9. To help control my weight	0	1	2	3	4	5
10.To accomplish things that others are incapable of	0	1	2	3	4	5
11. To improve my appearance	0	1	2	3	4	5
12. To gain recognition for my accomplishments	0	1	2	3	4	5
13. To help me look younger	0	1	2	3	4	5
14. To lose weight	0	1	2	3	4	5

15. To help manage my stress	0	1	2	3	4	5
Personally, I eat healthy (or might eat healthy)...	**Not at all true for me**				**Very true for me**	
16. To have a good body	0	1	2	3	4	5
17. To have fun eating healthy with other people	0	1	2	3	4	5
18. To spend time with friends	0	1	2	3	4	5
19. Because it helps to reduce tension	0	1	2	3	4	5
20. To feel more healthy	0	1	2	3	4	5
21. Because I want to maintain good health	0	1	2	3	4	5
22. To recharge my batteries	0	1	2	3	4	5
23. To help recover from an illness/injury	0	1	2	3	4	5
24. To give me goals to work towards	0	1	2	3	4	5
25. Because I enjoy the feeling of eating healthy	0	1	2	3	4	5
26. To give me personal challenges to face	0	1	2	3	4	5
27. To look more attractive	0	1	2	3	4	5
28. Because eating healthy helps me reduce calories	0	1	2	3	4	5
29. To have a healthy body	0	1	2	3	4	5
30. Because my doctor advised me to eat healthy	0	1	2	3	4	5
31. For enjoyment of the experience of eating healthy	0	1	2	3	4	5
32. Because I feel at my best when eating healthy	0	1	2	3	4	5

33. Because I find eating healthy invigorating	0	1	2	3	4	5
Personally I eat healthy (or might eat healthy)…						
	Not at all true for me					**Very true for me**
34. To compare my abilities with other peoples'	0	1	2	3	4	5
35. To measure myself against personal standards	0	1	2	3	4	5
36. To show my worth to others	0	1	2	3	4	5
37. To develop personal skills	0	1	2	3	4	5
38. To enjoy the social aspects of healthy eating	0	1	2	3	4	5
39. To avoid heart disease	0	1	2	3	4	5

Section 8: Exercisers might have very different goals on their minds for exercise. For example, some people are exercising because they believe that it will help them to become more appealing to others, whereas others believe it will help them become healthy. The following questionnaire explores the kind of goals you might have in mind while exercising. Please indicate to what extent these goals are important for you when exercising. Please be as honest as possible.

	Not at all important		***Moderately important***			***Very important***	
1. To connect with others in a meaningful manner	1	2	3	4	5	6	7
2. To improve the look of my overall body shape	1	2	3	4	5	6	7
3. To increase my resistance to illness and disease	1	2	3	4	5	6	7
4. To be well thought of by others	1	2	3	4	5	6	7
5. To acquire new exercise skills	1	2	3	4	5	6	7
6. To share my exercise experiences with people that care for me	1	2	3	4	5	6	7
7. To improve my appearance	1	2	3	4	5	6	7
8. To increase my energy level	1	2	3	4	5	6	7
9. To be socially respected by others	1	2	3	4	5	6	7
10. To learn and exercise new techniques	1	2	3	4	5	6	7
11. To develop close friendships	1	2	3	4	5	6	7
12. To be slim so to look attractive to others	1	2	3	4	5	6	7
13. To improve my overall health	1	2	3	4	5	6	7
14. To gain favourable approval from others	1	2	3	4	5	6	7
15. To become skilled at a certain exercise or activity	1	2	3	4	5	6	7
16. To form close bonds with others	1	2	3	4	5	6	7
17. To change my appearance by altering a specific area of my body	1	2	3	4	5	6	7
18. To improve my endurance, stamina	1	2	3	4	5	6	7
19. So that others recognize me as an exerciser	1	2	3	4	5	6	7

20. To develop my exercise skills.	1	2	3	4	5	6	7

Section 9: Please respond to each of the following statements by indicating the degree to which the statement is true for you when you engage in *physical activity*.

	Not at all true		Somewhat true			Very true	
1. I feel alive and vital.	1	2	3	4	5	6	7
2. I don't feel very energetic.	1	2	3	4	5	6	7
3. Sometimes I feel so alive I just want to burst	1	2	3	4	5	6	7
4. I have energy and spirit.	1	2	3	4	5	6	7
5. I look forward to each new day.	1	2	3	4	5	6	7
6. I nearly always feel alert and awake.	1	2	3	4	5	6	7
7. I feel energized	1	2	3	4	5	6	7

Section 10: We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The following questions will ask about the time you spent being physically active in the across a typical week. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise, or sport.

Section 10a: Considering only the past week (7 days), in your leisure time, how often did you engage in any regular physical activity long enough to work up a sweat (heart beats rapidly)? Please check only one of the following options

Never/Rarely	Sometimes	Often
☐	☐	☐

Section 10b: *The following questions are designed to ask you about the physical activities that you do. In answering the following questions, please keep the following definitions in mind.*

Vigourous *physical activities refers to activities that cause your heart to beat rapidly and lead to heavy sweating.*

Moderate *physical activities refer to activities that are not exhausting, but lead to light perspiration*

Mild *physical activities refer to activities that require minimal effort and no perspiration.*

(1) **During the last 7 days**, on **how many days** did you do **vigorous** physical activities like *heavy lifting, digging, aerobics, fast bicycling, carrying boxes, groceries or heavy objects (25+ lbs) upstairs, moving furniture, baling hay, shoveling heavy snow, etc…?* Think about *only* those physical activities that you did for at least 10 minutes at a time. **Please insert a number in BOX 1A between 0 and 7 days per week.**

BOX 1A
___days per week

How much time *in total* did you usually spend **on ONE of those days** doing vigorous physical activities? **Please insert a number for hours and / or minutes in BOX 1B.**

BOX 1B	_____HOURS _____MINUTES

(2) Again, thinking *only* about those physical activities that you did for at least 10 minutes at a time. **During the last 7 days**, on **how many days** did you do **moderate** physical activities like *carrying light loads, bicycling at a regular pace, easy swimming, dancing, heavier house cleaning (e.g., washing windows or car, scrubbing floors), heavier home repair (e.g., carpentry, cleaning gutters, painting, using power tools), heavier gardening (e.g., raking, digging, mowing, snowblowing),etc…*? **Please insert a number in BOX 2A between 0 and 7 days per week.**

BOX 2A
_____days per week

How much time *in total* did you usually spend **on ONE of those days** doing moderate physical activities? **Please insert a number for hours and / or minutes** in **BOX 2B.**

BOX 2B	_____HOURS _____MINUTES

(3) Again, thinking *only* about those physical activities that you did for at least 10 minutes at a time. **During the last 7 days**, on **how many days** did you do **mild** physical activities like *easy walking, yoga, slow dancing, fishing, bowling, golf, light housekeeping (e.g., dusting, washing dishes, vacuuming), light home repair (e.g., wiring or plumbing), light gardening (e.g., riding a ride-on mower), shopping, etc..?* **Please insert a number in BOX 3A between 0 and 7 days per week.**

BOX 3A
_____days per week

How much time in total did you usually spend **on ONE of those days** doing mild physical activities? **Please insert a number for hours and / or minutes in BOX 3B.**

BOX 3B	_____HOURS _____MINUTES

***Section 11**: There are a variety of reasons why people regulate their eating behaviours. Different people have different reasons for eating a healthy diet, and we want to know a little bit more about why you choose to do so currently or would choose to do so in the future. The following questions outline different reasons why you currently do (or would) eat a healthy diet. Please indicate the extent to which each reason is true for you on the scale provided.*

Why are you regulating your eating behaviours?	Does not correspond at all						Corresponds exactly
1. I don't want to be ashamed of how I look	1	2	3	4	5	6	7
2. I don't know why I bother	1	2	3	4	5	6	7
3. Eating healthy is part of the way I have chosen to live my life	1	2	3	4	5	6	7
4. Other people close to me will be upset if I don't	1	2	3	4	5	6	7
5. I would be humiliated if I was not in control of my eating behaviours	1	2	3	4	5	6	7
6. I can't see what I'm getting out of it	1	2	3	4	5	6	7
7. I can't see how my efforts to eat healthy are helping my health situation	1	2	3	4	5	6	7
8. It's fun to create meals that are good for my health	1	2	3	4	5	6	7
9. I believe it's a good thing I can do to feel better about myself in general	1	2	3	4	5	6	7
10. I believe it will eventually allow me to feel better	1	2	3	4	5	6	7
11. For the satisfaction of eating healthy	1	2	3	4	5	6	7
12. I take pleasure in fixing healthy meals	1	2	3	4	5	6	7
13. I truly have the impression that I'm wasting my time	1	2	3	4	5	6	7
14. Eating healthy is congruent with other important aspects of my life	1	2	3	4	5	6	7
15. Other people close to me insist I do	1	2	3	4	5	6	7

16. Eating healthy is an integral part of my life	1	2	3	4	5	6	7
Why are you regulating your eating behaviours?	Does not correspond at all						Corresponds exactly
17. It is a way to ensure long-term health benefits	1	2	3	4	5	6	7
18. It is a good idea to try and regulate my eating behaviours	1	2	3	4	5	6	7
19. I like to find new ways to create meals that are good for my health	1	2	3	4	5	6	7
20. Regulating my eating behaviours has become a fundamental part of who I am	1	2	3	4	5	6	7
21. It is expected of me	1	2	3	4	5	6	7
22. I would feel ashamed of myself if I was not eating healthy	1	2	3	4	5	6	7
23. People around me nag me to do it	1	2	3	4	5	6	7
24. I feel I must absolutely be thin	1	2	3	4	5	6	7

Section 12: The following instrument is designed to assess aspects of your nutritional and dietary behaviours. Please answer the following questions by considering what you eat in an average week.

In an average week, how often do you:	Usually/Often	Sometimes	Rarely/ Never	Does not apply to me
1. Skip breakfast?	O	O	O	
2. Eat 4 or more meals from sit-down or take-out restaurants?	O	O	O	
3. Eat less than 2 servings of whole grain products or high fiber starches a day? **Serving** = 1 slice of 100% whole grain bread; 1 cup whole grain cereal like Shredded Wheat, Wheaties, Grape Nuts, high fiber cereals, oatmeal, 3-4 whole grain crackers, ½ cup brown rice or whole wheat pasta, boiled or baked potatoes, yucca, yams or plantain.	O	O	O	
4. Eat less than 2 servings of fruit a day? **Serving** = ½ cup or 1 med. Fruit or ¾ cup 100% fruit juice.	O	O	O	
5. Eat less than 2 servings of vegetables a day? **Serving** = ½ cup vegetables or 1 cup leafy raw vegetables.	O	O	O	
6. Eat or drink less than 2 servings of milk, yogurt, or cheese a day? **Serving** = 1 cup milk or yogurt; 11/2 - 2 ounces cheese	O	O	O	
7. Eat more than 8 ounces (see sizes below) of meat, chicken, turkey or fish per day? ***Note**: 3 ounces of meat or chicken is the size of a deck of cards or ONE of the following: 1 regular hamburger, 1 chicken breast or leg (thigh and drumstick), or 1 pork chop.*	O	O	O	**Rarely eat meat, chicken, turkey or fish** O
8. Use regular processed meats (like bologna, salami, corned beef, hot dogs, sausage or bacon) instead of low fat processed meats (like roast	O	O	O	**Rarely eat processed meats** O

beef, turkey, lean ham, low-fat cold cuts/hotdogs)?				
9. Eat <u>fried foods</u> such as fried chicken, fried fish, French fries, fried plantains, tostones or fried yucca?	O	O	O	
10. Eat <u>regular potato chips, nacho chips, corn chips, crackers, regular popcorn, nuts</u> instead of pretzels, low-fat chips or low-fat crackers, air-popped popcorn?	O	O	O	**Rarely eat these snack foods** O
11. Add <u>butter, margarine or oil</u> to bread, potatoes, rice or vegetables at the table?	O	O	O	
12. Eat <u>sweets</u> like cake, cookies, pastries, donuts, muffins, chocolate and candies more than 2 times per day?	O	O	O	
13. <u>Drink 16 ounces or more</u> of non-diet soda, fruit drink/punch or Kool-Aid a day? **Note**: 1 can of soda = 12 ounces	O	O	O	
	YES		NO	
14. You or a member of your family usually shops and cooks rather than eating sit-down or take-out restaurant food?	O		O	
15. Usually feel well enough to shop or cook.	O		O	
16. How willing are you to make changes in your eating habits in order to be healthier?	1 Very Willing	2	3	3	5 Not at all Willing

Thank You

Thank you for taking time to participate in our research study. Please remember to schedule your next assessment for 12 weeks from now. You will be receiving a reminder about your scheduled appointment one week prior to the date set.

Appendix G

Study Flowchart

Study Flowchart